RAILROAD GAZETTE

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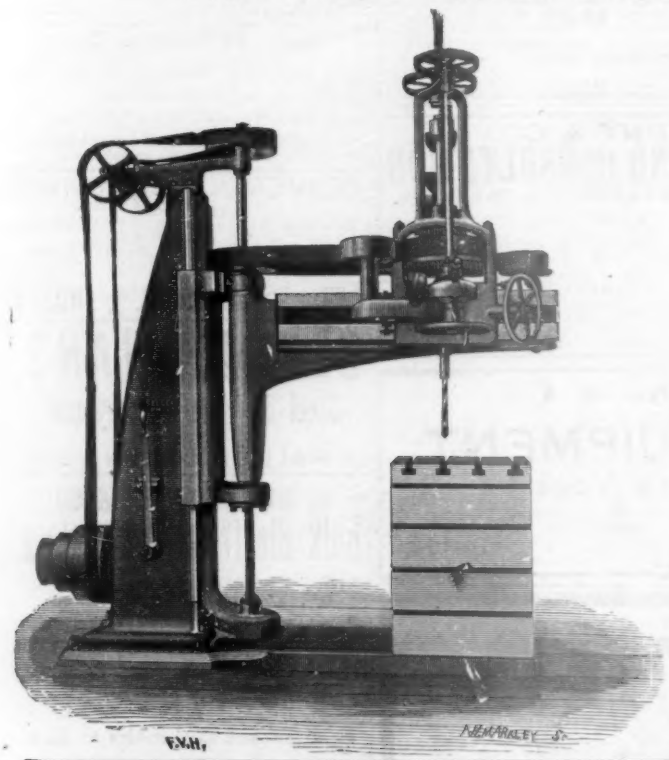

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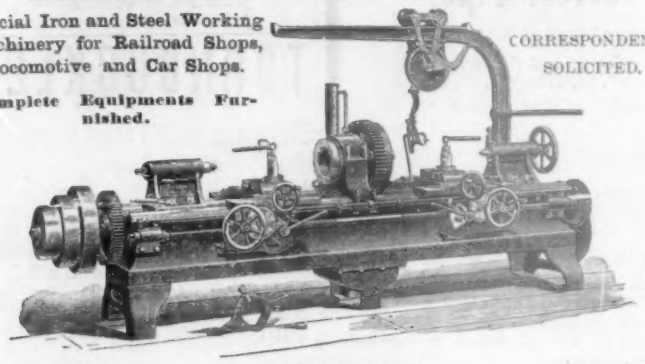

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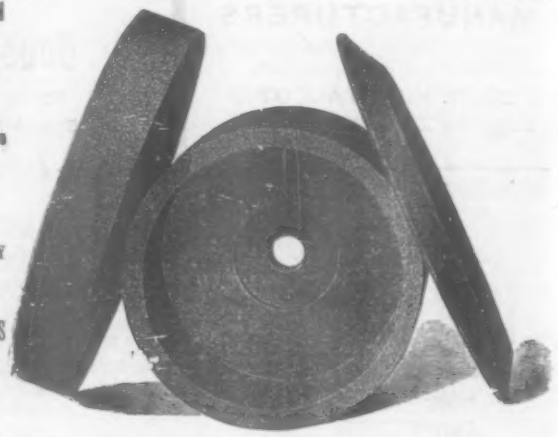

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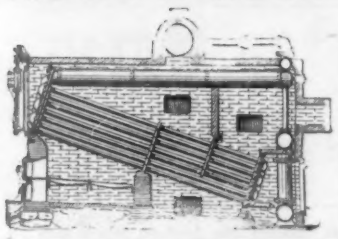

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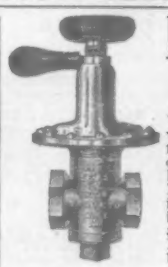

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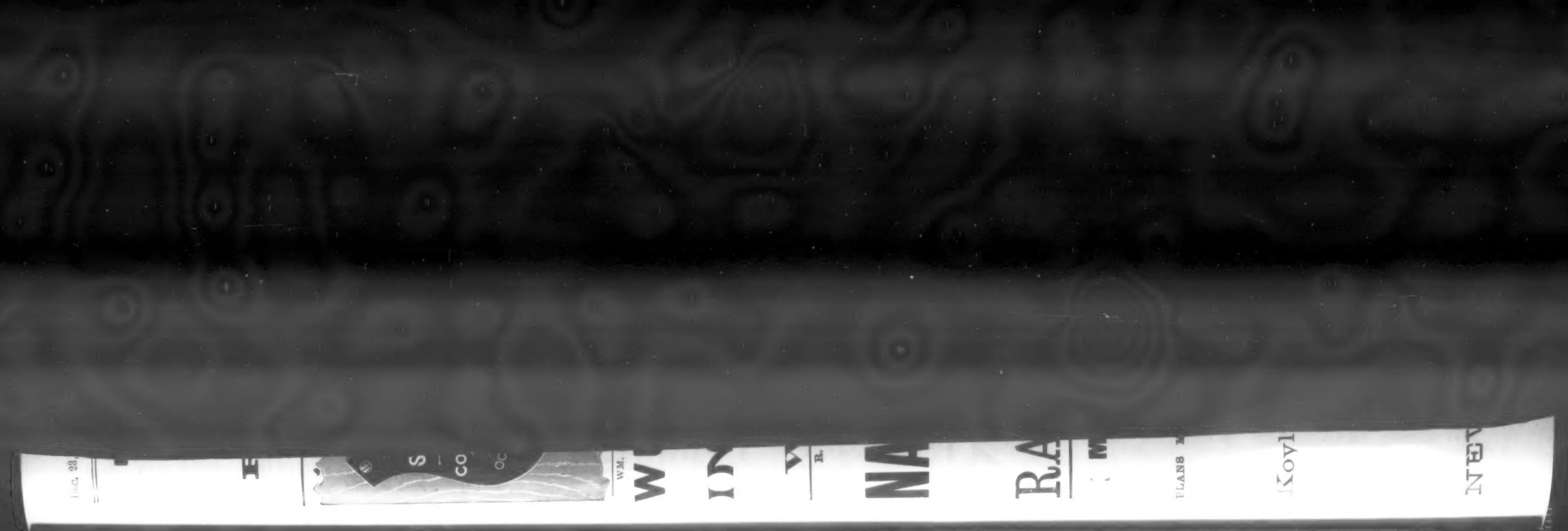

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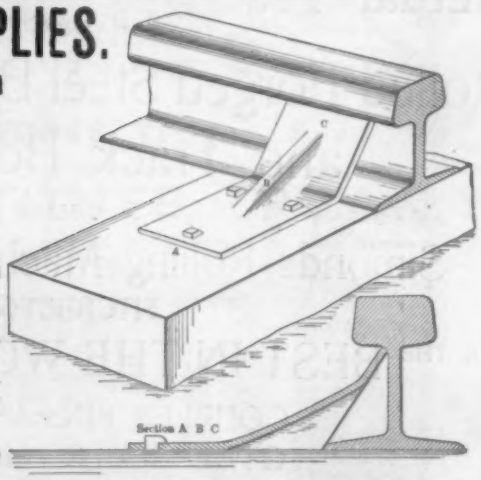

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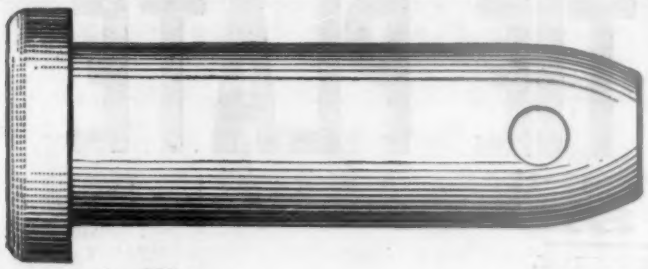

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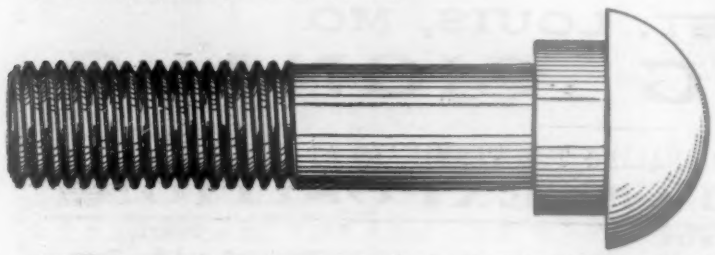

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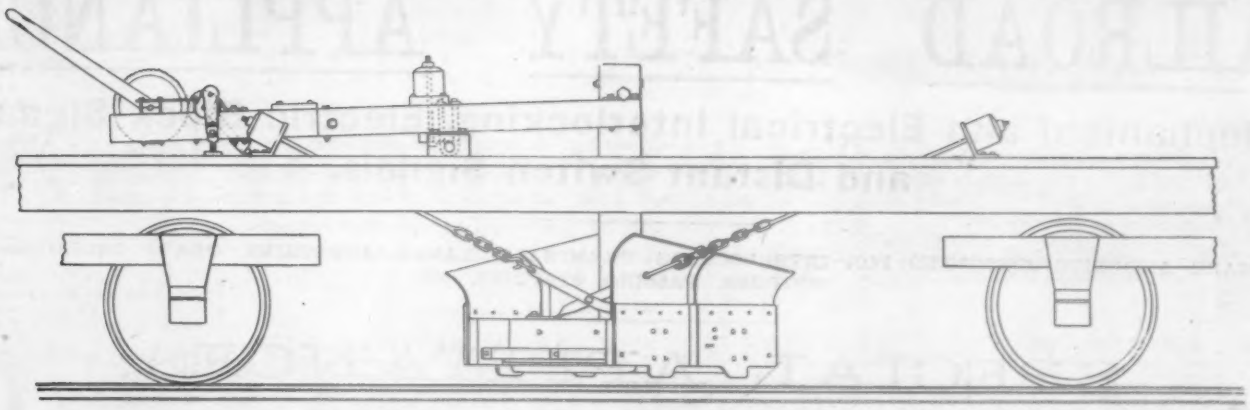

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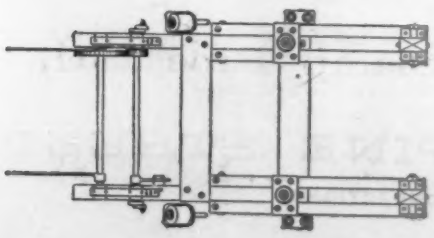

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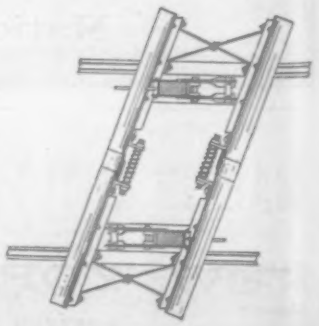

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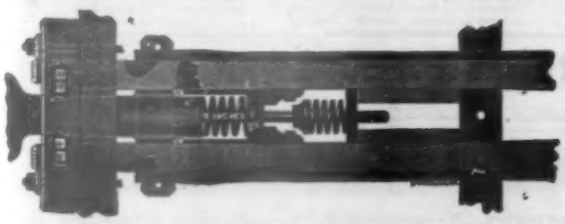

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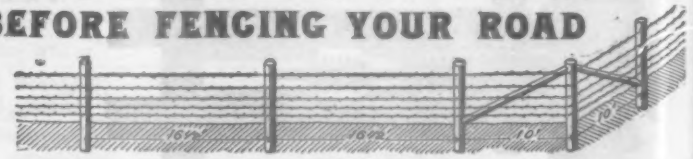

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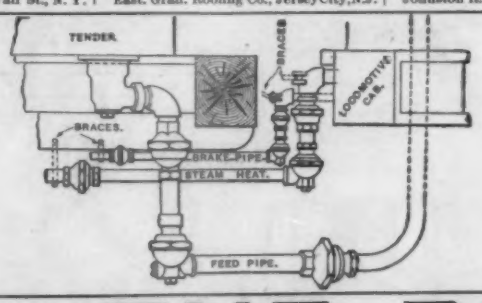

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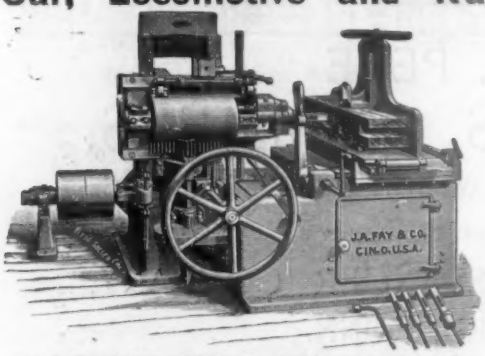

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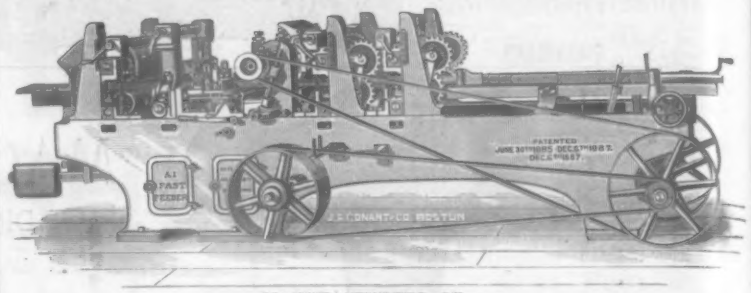

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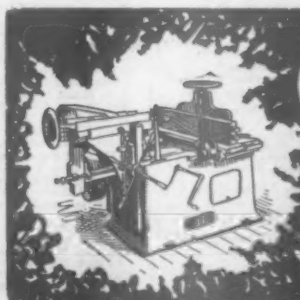

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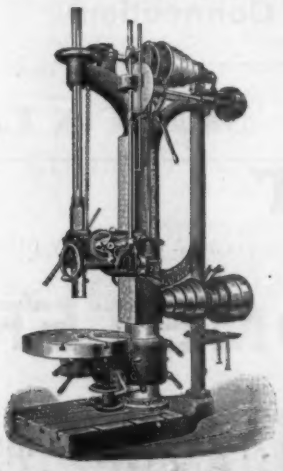

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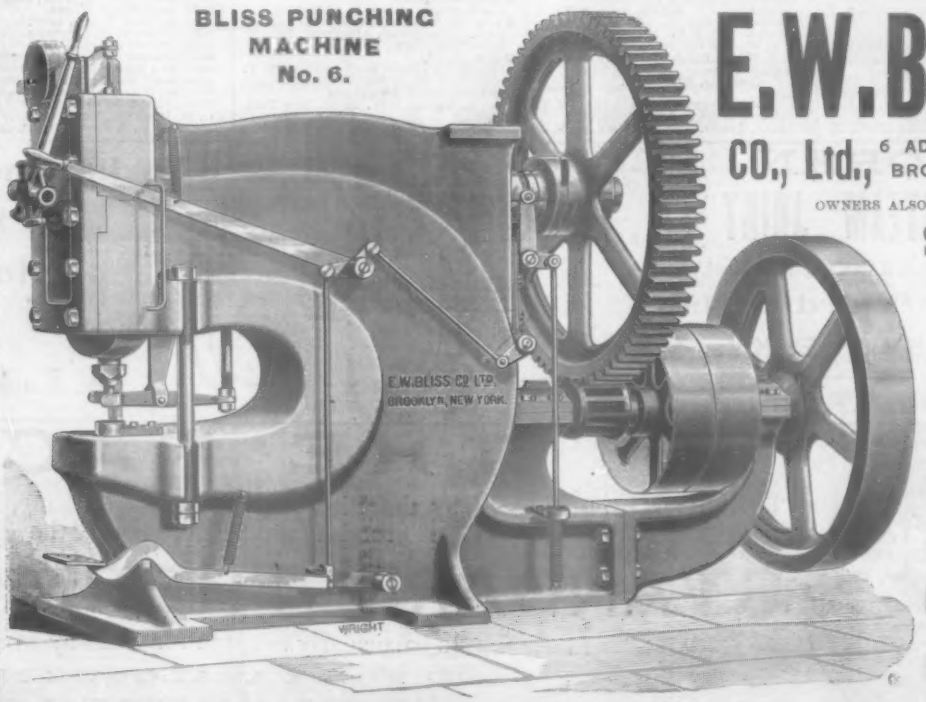

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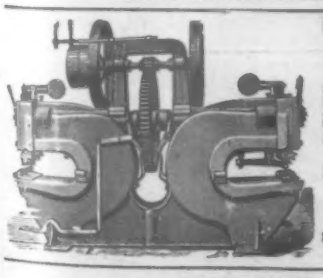

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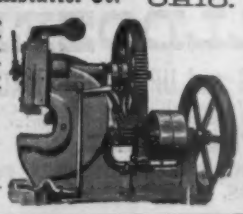

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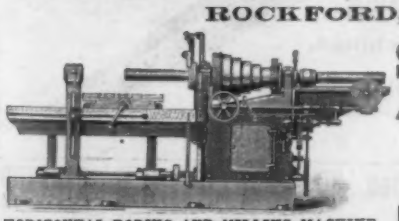

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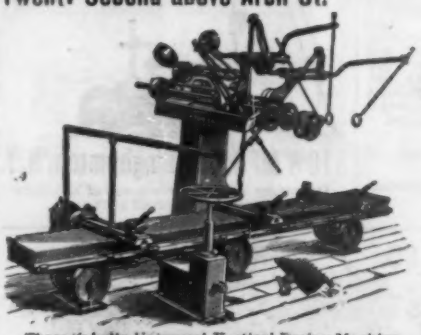

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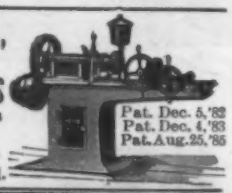

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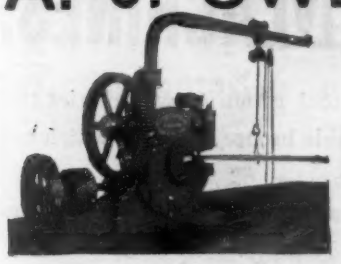

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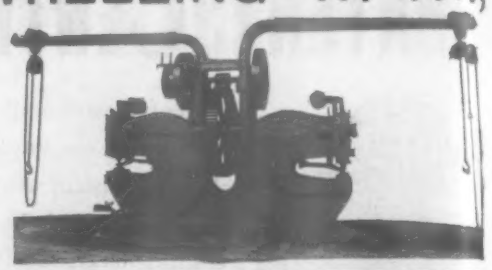

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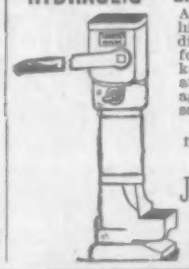

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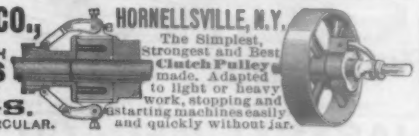

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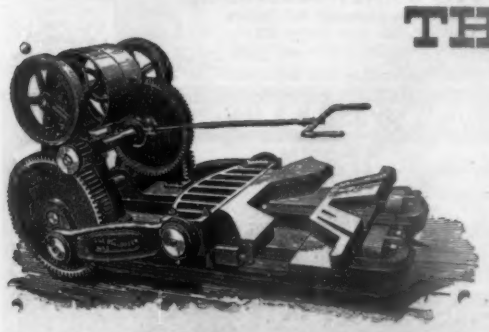

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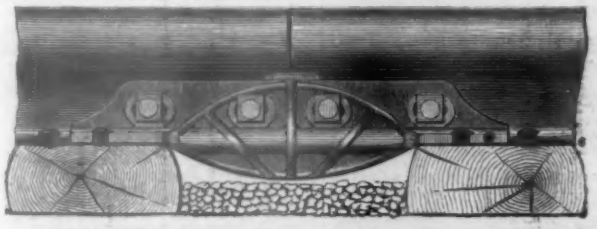

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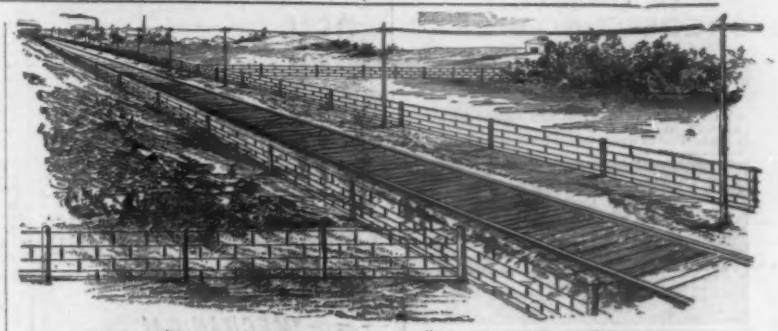

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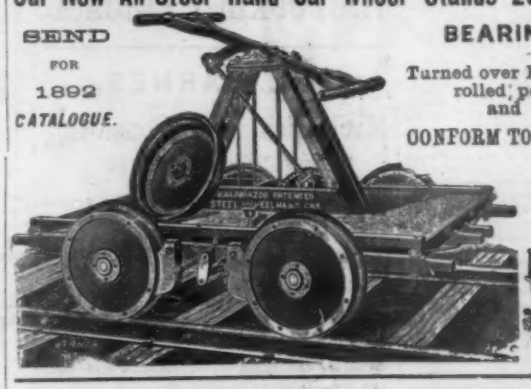

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Said work is divided into sections (the dredging of the Illinois and Michigan canal being one section), each of which will be treated as a separate contract in canvassing the proposals and making awards. As all awards will be made by individual sections as provided in the specifications and forms of proposals to be furnished bidders, each bidder must make price for each section separate and distinct from every other. The lumping of prices in any bid will render such bid informal and will cause its rejection by the said Board o Trustees.

Each proposal must be accompanied by a certified check or cash to an amount equal to $3,000 multiplied by the number of sections bid upon.

All certified checks must be drawn on some responsible bank doing business in the city of Chicago and be made payable to the order of the Clerk of the Sanitary District of Chicago. Said amount of $3,000 for each section will be held by the Sanitary District until all of said proposals have been canvassed and contracts awarded and signed, the return of said check or cash being conditioned upon any bidder to whom an award of any portion of said work may be made appearing within ten days after notice of such award being given, with bondsmen and executing a contract with the Sanitary District for the section or sections of said work so awarded and giving a bond satisfactory to the said Board of Trustees for the fulfillment of the same in the amount of $75,000 for each section of work awarded him.

All proposals must be made upon blank forms furnished by the Sanitary District and must give the price for each separate item of work.

The bids will be compared on the basis of the Engineer's approximate estimate of quantities, which will be furnished with copies of the specifications.

No proposal will be considered unless the party making it shall furnish evidence satisfactory to the Board of Trustees of his ability to do the work and that he has the necessary pecuniary resources to fulfill the conditions of the contract, provided such contract shall be awarded him.

Bidders are required to state in their proposals their individual names and places of residence in full.

Specifications and plans may be seen at the office of the Chief Engineer, Room D Rialto building, Chicago, Ill.

The said Board of Trustees reserves the right to reject any and all bids.

THE SANITARY DISTRICT OF CHICAGO,
By FRANK WENTER, President.
Attest: THOMAS F. JUDGE, Clerk.
Chicago, Nov. 25, 1892.

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N. Y. Supreme Court, Dutchess County.

LEWIS H. VAIL, as trustee for the holders of the first-mortgage bonds of the Poughkeepsie, Hartford & Boston Railroad Company, *Plaintiff.*

Against

THE POUGHKEEPSIE, HARTFORD & BOSTON RAILROAD COMPANY, Edward Elsworth, individually and as mortgagee in a certain mortgage deed recorded in the office of the Clerk of the County of Dutchess, in Liber 156, pages 213, etc., of mortgages, and as trustee under such mortgage deed, and others, *Defendants.*

Pursuant to a judgment of foreclosure and sale granted on the 6th day of February, 1886, and entered in the Dutchess County Clerk's office in an action wherein John P. Adriance, as Trustee, etc., was plaintiff and the Poughkeepsie, Hartford & Boston Railroad Company and others were defendants (the said John P. Adriance having died and the said Lewis H. Vail having been substituted as Trustee and Plaintiff in said action), I, the undersigned, the Referee appointed by the said judgment for that purpose, will sell, at public auction at the east front door of the Court House in the City of Poughkeepsie, Dutchess County, New York, on Thursday, the 26th day of January, 1893, at twelve o'clock noon, the premises described in said judgment and in the mortgage therein referred to, and which are therein described as follows:

"All and singular, the railroad of the said Poughkeepsie, Hartford & Boston Railroad Company" (now known as the New York & Massachusetts Railway), "now or hereafter to be constructed, being about 47 miles long and extending from the Hudson River at the City of Poughkeepsie through, or as near as practicable, to the Villages of Salt Point, Stanfordville, Stissing and Pine Plains, in Dutchess County, and Boston Corners, in Columbia County, New York, to a point in the line between the States of New York and Connecticut, near the village of Millerton, in the State of New York, the said railroad connecting at that point with the Connecticut Western Railroad, together with all and singular the franchises of the said Poughkeepsie, Hartford and Boston Railroad Company, and its equipments, property, tolls, rents, issues and profits, its lands, tenements, buildings, fixtures, machinery, rolling stock, goods and chattels connected with the operating of the said railroad, or appurtenant thereto, and all rails, ties, fencing and erections, right of way and easements, including all property, real and personal, now or hereafter to be acquired by the said Poughkeepsie, Hartford & Boston Railroad Company, either in law or equity, of what kind soever purtenant thereto.

"Excepting and reserving out of the above described premises and property that part thereof lying between Boston Corners and state line, a particular description of which is contained in a deed thereof made by Abram J. Rose, Referee to the Hartford & Connecticut Western Railroad Co., dated 1st of April, 1884, and recorded in the Dutchess County Clerk's office in Liber of Deeds 216, pages 466, etc., on the 5th day of April, 1884, and also recorded in the Columbia County Clerk's office in Liber of Deeds 76, pages 258, etc., on the 9th day of April, 1884, to which deed and the records thereof reference is made.

"The premises hereinbefore described include and this decree is against those certain lots and parcels of land described as follows:

All that land in the town of Stanford, Dutchess County, and in North Millbrook street, in the City of Poughkeepsie, mentioned and described in a declaration of trust made by George Innis to the Poughkeepsie & Eastern Railroad Company, and dated August 14, 1871, and recorded in the Dutchess County Clerk's office in Liber 176, page 565, of Deeds.

"Also all that land in said City of Poughkeepsie lying south of Oakley Street, which was conveyed to George Innis by the Poughkeepsie, Hartford & Boston Railroad Company by deed dated July 15, 1875, which is recorded in the office of the Dutchess County Clerk, in Liber 181 of Deeds, page 95."

Pursuant to the decree aforesaid all said mortgaged premises will be sold by me in one parcel.

ABRAM J. ROSE, *Referee.*

Dated Dec. 6 1892.

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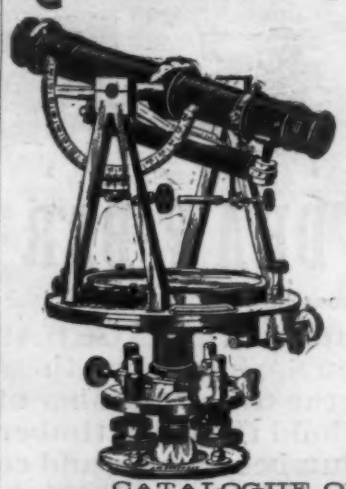

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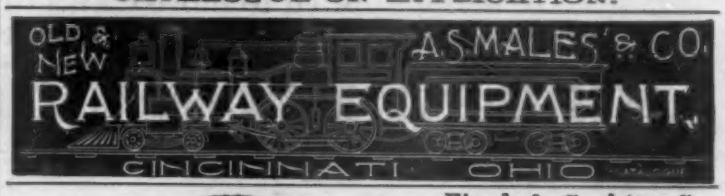

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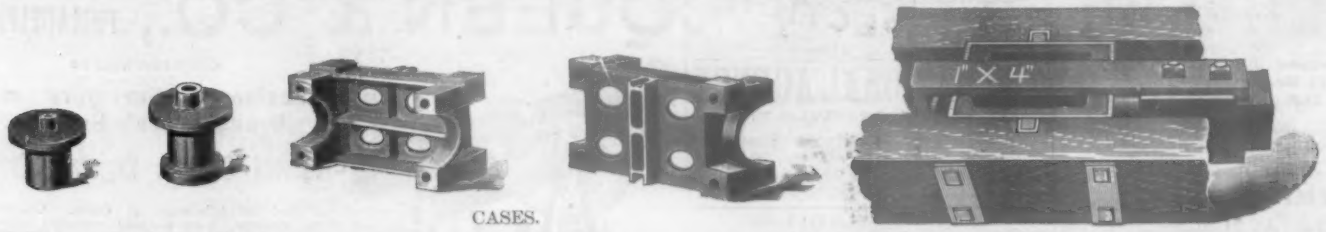

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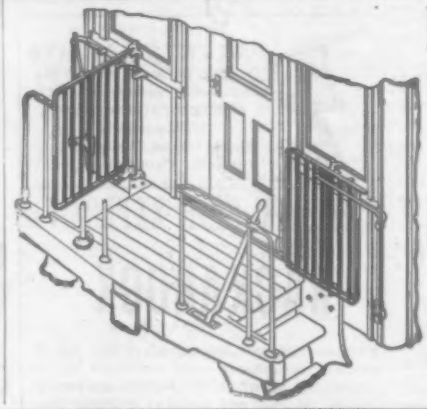

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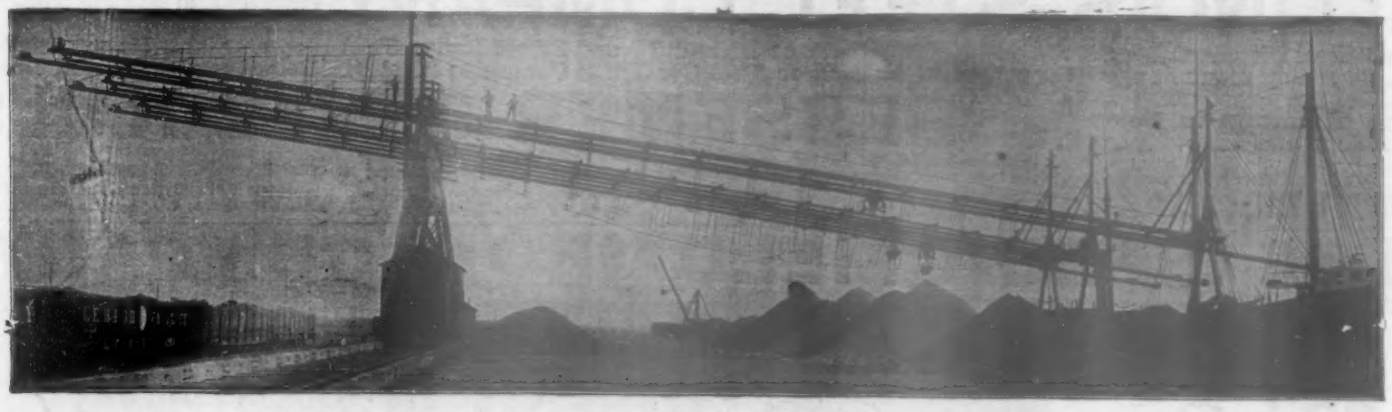

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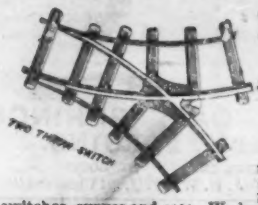

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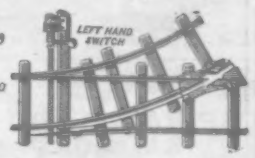

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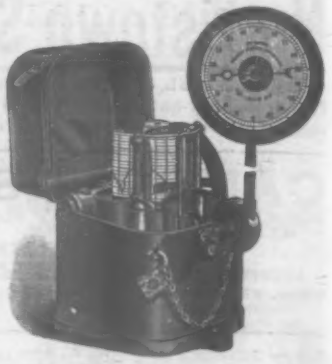

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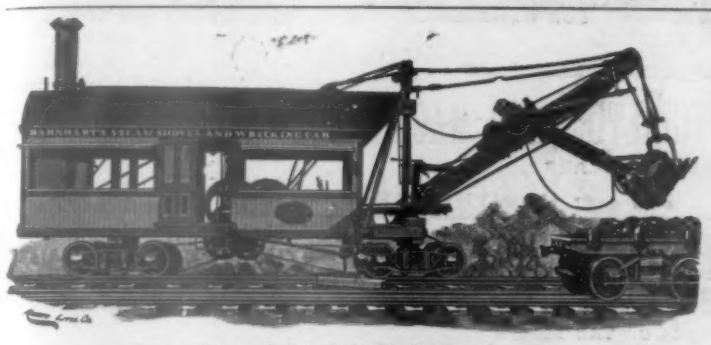

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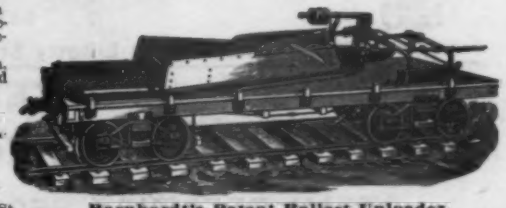

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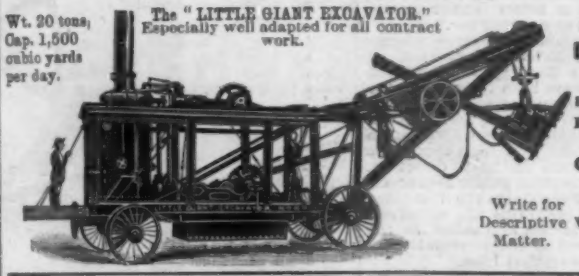

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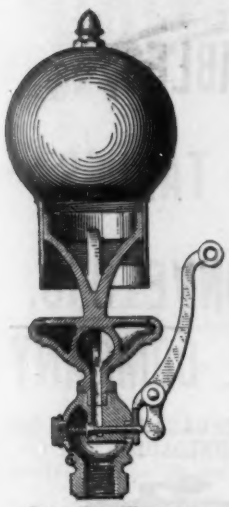

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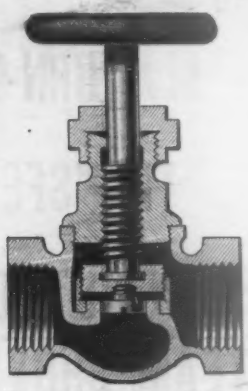

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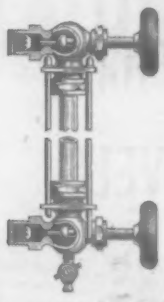

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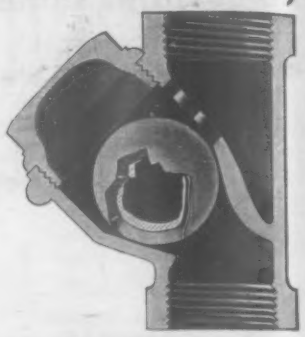

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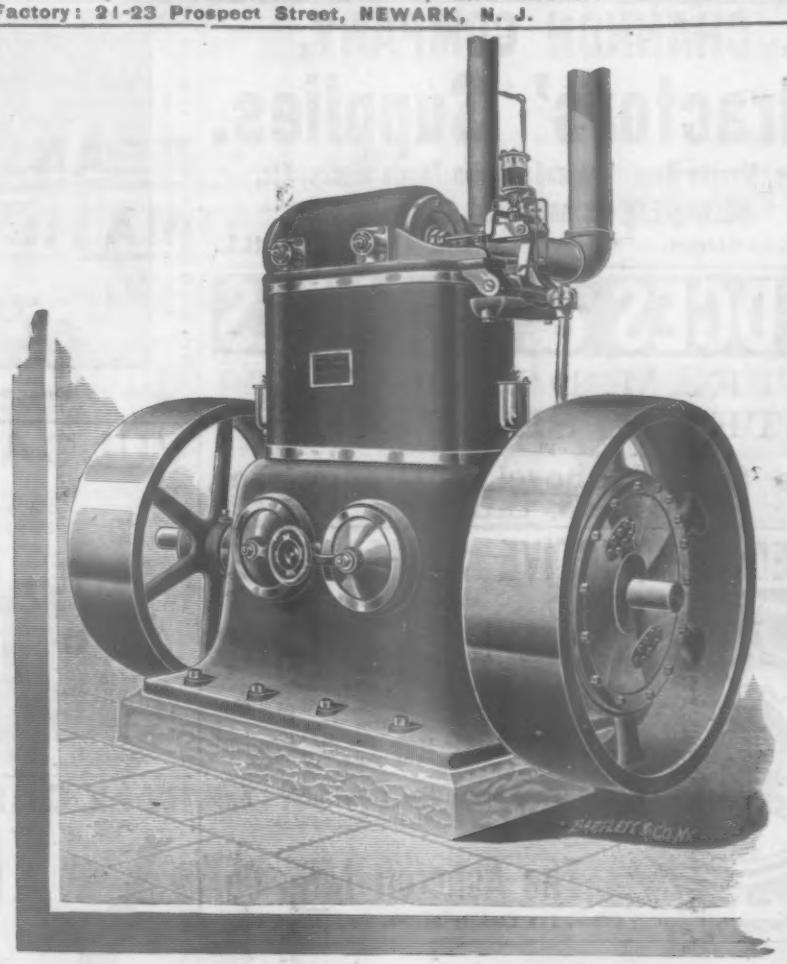

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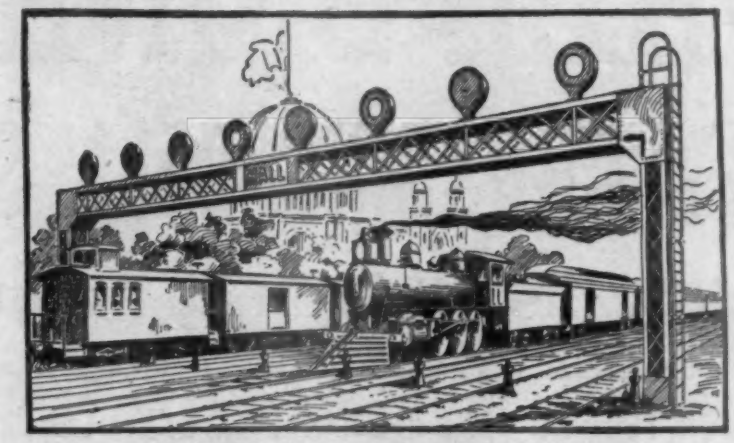

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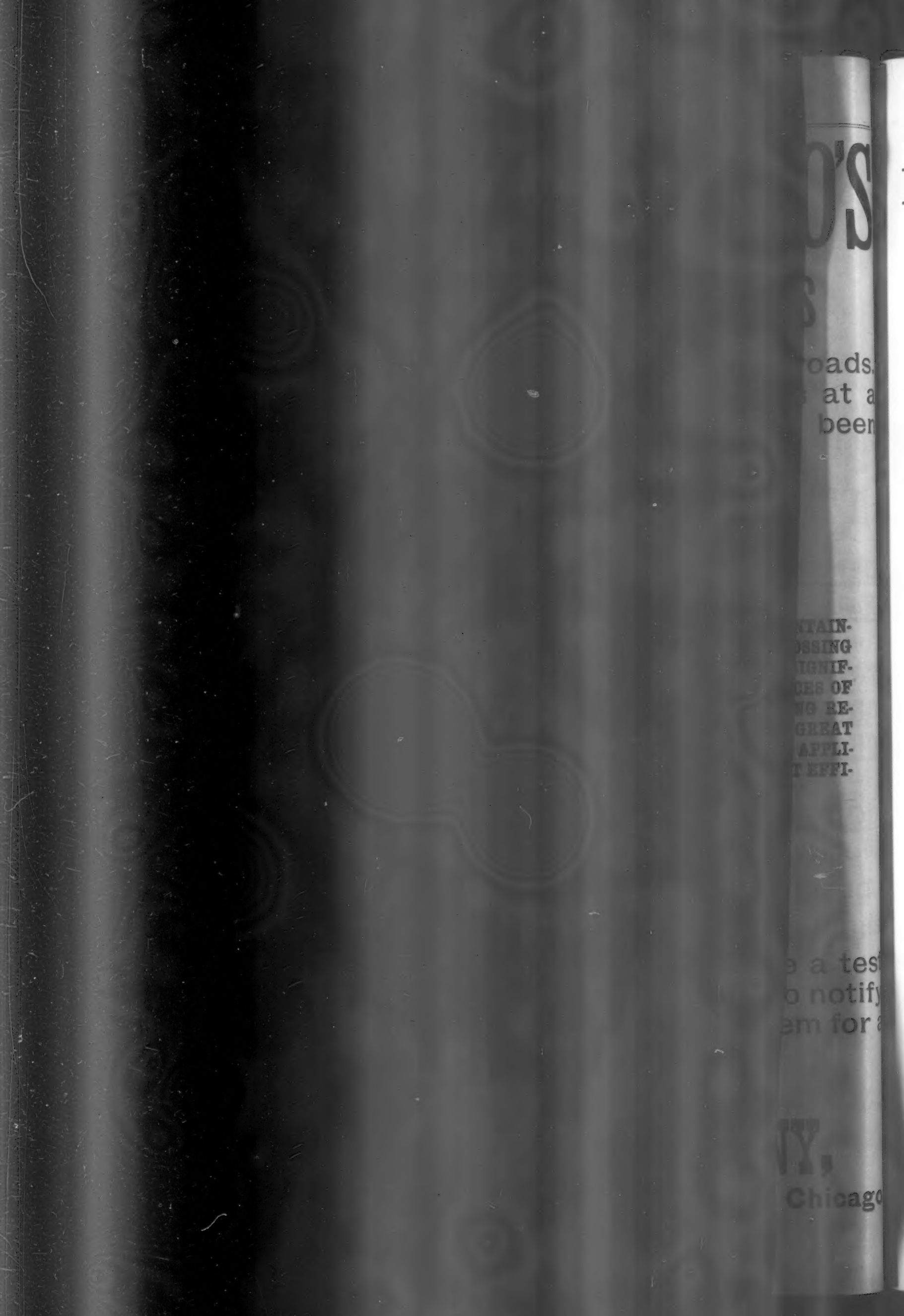

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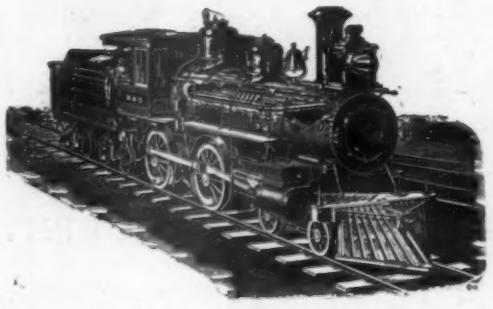

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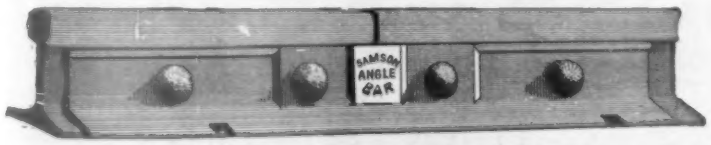

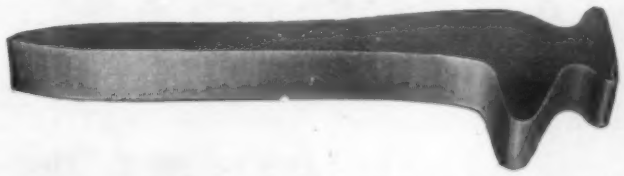

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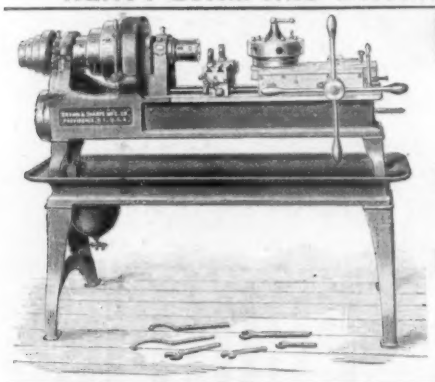

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Facts on Varnish.

NO. 136.—TWO ESSENTIALS.

The essentials to good authorship, says Charles Reade, are common-sense and elegance. Common-sense, a very uncommon article, for the basis of work: an elegant dress of words and phrases for the literary reception.

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RAILROAD GAZETTE

FRIDAY, DEC. 23, 1892.

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Contributions.

Experience with Rail-Circuit Signals.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have been reading your editorial of Nov. 25, concerning extra locks on interlocked signal levers to protect trains at stations. It seems to me that both of the two principal ideas are good. The staff system, by which the tower-man would require a west bound freight conductor to come and get a tangible certificate before letting him set his train off upon the eastbound main track, ought to work well. A conductor ought to be as ready and willing to do this as to delegate one of his brakemen to go out with a flag on the eastbound track, and we have now got them "jacked up" so that they do this tolerably well.

The rail circuit is, however, the ideal protection, if it were not so very costly. I do not admit the validity of some of the criticisms passed upon the rail circuit, but it is undeniable that the faults alleged by the critics can be overcome only by lavish expenditures. I hold that the system can properly be used only where, on account of the volume of business, safety is so important that it can be used practically regardless of expense. It is an expensive system, both in first cost and in maintenance, and it requires a high class of intelligence and work.

For the successful use of the rail circuit it is very necessary to have a well ballasted, thoroughly drained track, with very few street crossings at grade. A plank crossing interferes so much with the working of the rail circuit that, unless the circuit is cut out and bridged over at these points (which causes an intermittent action of the signals when a very short train goes over the crossing), there is constant trouble. Then, again, a dynamo is necessary. A battery current has proved, in my experience, to be an expensive and unsatisfactory method of supplying electricity for the rail circuit. A storage battery, which can be conveniently charged from a dynamo current, is far more satisfactory. We have found that in order to give satisfactory results the intensity of the current should be changed according to the atmospheric conditions, and this can be done very readily if storage batteries are used. If these obstacles are properly dealt with any one ought to get good service.

I do not wonder that you find contradictory testimony concerning the reliability of rail circuits. I know of some roads where a very poor grade of men are called "skilled" workmen, and it is a wonder that they get good results at all. Other roads neglect their records and they will therefore report a good record, when if the truth were known they have taken no measures to learn whether the signals have always worked properly or not. We shall always have conflicting opinions as long as poorly qualified linemen, batterymen and electricians are employed by roads which hire well-qualified men in other departments. The general good reputation of such a road gives to the electrical department a better "character" than it deserves. It is true that competent men cannot be picked up every day in the week, but that is all the more reason why a road should take care to "cultivate" what few good men it can get hold of.

The rail circuit is an indispensable adjunct to all complete interlocking (as well as all block signaling) and it is to be hoped that its use will extend; but we whose roads do not enjoy the heavy traffic of the great trunk lines must wait for it a number of years yet. Meanwhile it should be used at favorable locations so that our men may familiarize themselves with its nature and peculiarites and learn the art of properly taking care of it.

SUPERINTENDENT.

One of the Loose Screws in Car Service.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The article printed in your columns Dec. 16 in regard to junction cards reminds me of one of the chief sources of error in that most useful report. I allude to the discrepancies arising between the records of different railroads in regard to the interchange of cars at points at which there are no regular agents. All the arrangements made by the American Railway Association and the Car Accountants' Association assume that there will be a regular agent of each company on the ground to look after interchanges; but there are many points of interchange where the agents' offices are so far distant that there are often differences of opinion as to the hour, and sometimes as to the date, when the actual delivery of a car is made.

Since the grand clear-up of the interchange system which was made during the per diem experiment, it has been pretty generally admitted on all hands that when a car is placed on the recognized interchange siding and the billing for the car is delivered, that the car is also delivered, no matter when it is taken away; and an arrangement of this kind is easily enough carried out at regular junction points; but when the cars are dropped on some obscure siding by the conductor of one railroad on one afternoon and are taken away by a conductor of the other railroad next morning, the billing having been sent across the hills during the night by passenger train, or by a United States mail wagon, there is a good deal of room for doubt as to the exact date of delivery, and when the per diem phœnix arises again from its ashes such misunderstandings will arise again to perplex the transportation officers.

During the per diem experiment, when, of course, the date of interchange was all important, a temporary arrangement was made between two railroads having this informal sort of interchange at a certain point, by which copies of their conductor's reports showing delivery were sent by each road to the other and each railroad accepted the date given by the other railroad's conductor as the proper date of interchange, no matter on what date their own conductors took the cars away, but such a trustful arrangement as that was (almost as arcadian as the present mileage system) will hardly do when the date of interchange again becomes a matter of money.

The English clearing-house system would easily settle questions of this kind by putting the necessary number-takers at these junction points, but there seems little likelihood that the American railroads will ever submit to the bondage of this clearing-house red tape, although they have submitted to an astonishing lot of red tape in the establishing of the demurrage associations.

When some check on conductors does become necessary at points of this kind it will probably be found that there is a track foreman or perhaps a track laborer, sufficiently intelligent to take the car numbers and the time when deliveries are made, and perhaps impartial enough to act for both railroads, but it would doubtless take a money stimulus to induce our railroads to protect their frontiers even in as slipshod a way as this.

The other points at which there is difficulty are the private sidings belonging to "industrial" companies, whose works are connected with more than one railroad. So long as a private corporation has connection only with one railroad its tracks can readily enough be considered a part of that system, but when the shop or yard is connected with two railroads it becomes very much more independent of both of them and much less compliant with their regulations. It is sometimes found that both of the railroads begin to regard such tracks in the light of an independent railroad, and it is not unusual to see cars shown on junction reports as delivered to large firms, exactly as if they were incorporated belt railroads.

In such cases it is, of course, necessary for both railroads to keep the most careful watch upon the private corporation to see that they get back all the cars which they have delivered, both loaded and empty; and when, as sometimes seems really necessary, a car coming to such a consignee over one railroad is loaded out over another, that fact should be reported to the owner of the car on the regular junction report exactly as if interchange were made at an "authorized" junction point. Where such an interchange is made care should, of course, be taken that the railroad accepting the car gives the proper receipt for it. This is seldom done at present, certainly not more frequently than at the points spoken of above where there are no agents.

It must be confessed that these things show a very unsystematic method of doing business between railroads. The English railroad officer, accustomed to the exactness of the Clearing House or the continental officer accustomed to his accurate locations, showing from week to week or from day to day the exact number of cars upon his line, would probably find it hard to believe that on this side of the Atlantic—in Canada as well as in the United States—there is no railroad which has an absolutely reliable report of interchanges from all its junction points. But as long as there is no particular need for spending money on such reliable a report, there is no great probability of our having it. It really makes no difference to the average railroad whether this or that particular foreign car is on its own line or on its neighbor's. Tracers for cars, either in statement or letter shape, are treated as routine business, and if a car should happen to be destroyed near a junction point it would probably have enough remains to show on whose territory it stood at the time of destruction. Until a businesslike method of compensation for car service is adopted, it seems likely that we shall have an unbusinesslike method of determining and reporting interchanges.

C. D. E.

Michigan Central Track Tanks—Correction.

The illustrated description of these tanks, printed in the *Railroad Gazette* of Dec. 16, omitted to state that the water is supplied to the tanks by means of a pipe entering, at the most convenient point, through a box riveted to the bottom of the tank. From this box it flows into the tank through a 5-in. orifice. The pipes for admitting steam, which it was erroneously stated were for both water and steam, are placed about 40 ft. apart, the whole length of the tank. The construction of these, as will be seen by the engraving, is such as will throw the jet of steam downward.

The New Hydraulic Works at Niagara Falls.*

Sir William Siemens is reported to have said that if all the daily output of coal in the world could be used in making steam to drive pumps it would barely suffice to pump back the water flowing down Niagara River. Because of this impressive fact many schemes have been brought forward, discussed and discarded. It has always been conceded that as a first essential to the employment of any part of this water for the generation of power the picturesque aspect of the place should not be interfered with. This has led directly to the condemnation of many of the plans proposed. Some 40 years ago the so-called hydraulic canal, operating factories about one-quarter mile below the Falls, was built. This canal is 50 ft. wide by 6 ft. deep, and the total horse power obtained from it is only about 6,000. Up to the present time this has been the only scheme which has been carried to any state of perfection for the utilization of a part of the water. We understand that this plant, or more generally speaking the several plants depending on the canal for their power supply, will be overhauled and arranged more in accordance with modern engineering ideas.

The Plan in General.—Thomas Evershed, formerly State Engineer of New York, proposed some years since a method of utilizing the falls that possessed many admirable features. It detracted nothing from the beauty of the scenery, and it provided for obtaining an almost unlimited power. The direct outgrowth of the plan then proposed is the scheme now being carried forward. A charter was granted in 1886 to the Niagara River Hydraulic Power & Sewer Co. of Niagara Falls, N. Y., the successor of which company is the present Niagara Falls Power Co. In brief, the plans consist in building a canal a little over a mile above the Falls, on the American side, taking the water from this canal in vertical shafts united at their bottom by tunnels leading to one main tunnel or raceway, having its outfall about 1,000 ft. down stream from the Falls. The builders of this work are the Cataract Construction Co., having for its staff the following prominent engineers: Albert H. Porter, Chief Engineer; Coleman Sellers, John Bogart and Theo. Turrettini, Consulting Engineers; Geo. B. Burbank, Resident Engineer, and Prof. Geo. Forbes, Consulting Electrical Engineer, Clemens Herschell being the Hydraulic Engineer.

The first work was to secure a strip of land along upper Niagara River and extending some distance back from the shore. This property was necessary in order to fully carry out the plans decided upon. In a general way these plans consist in furnishing sites for factories and a sufficient amount of water to run these factories, the development of the power being left to the owner of the factory.

The second part of the programme contemplates the generation of power by the company and its transmission to and final utilization at any desired points. The plans, it will be noticed, therefore divide themselves into two distinct parts, one in which the water is delivered to the factory by the company, and after it has been used for the development of power its conveying away through the tunnel built by the company. This is a mere bringing to and taking away from a particular location a certain quantity of water. In the second electricity will be generated by the company and then transmitted through suitable conductors to any particular site desired. As an illustration of the adoption of the first method, we may state that the Niagara Falls Paper Co. very early acquired land adjoining the canal and began work on

* Reprinted by permission from the *Iron Age* of Dec. 8, 1892.

their own shafts and buildings. They have let contracts to R. D. Wood & Co., of Philadelphia, for turbines for the development of 3,000 H. P. under a head of 140 ft., having the privilege of increasing this by 3,000 more if required. Owing to the fact that this company early

the president of the company, and Coleman Sellers, of the principal methods of utilizing a fall of water. For this purpose these gentlemen visited Europe and carefully inspected the plans there in operation, particularly in Switzerland. Owing to the vast volume of water

development, and this formed one of the most important parts of the subject looked into. It was finally decided to appoint an International Niagara Commission, composed of men of eminent talent, who were to invite plans for the most prominent and competent engineers

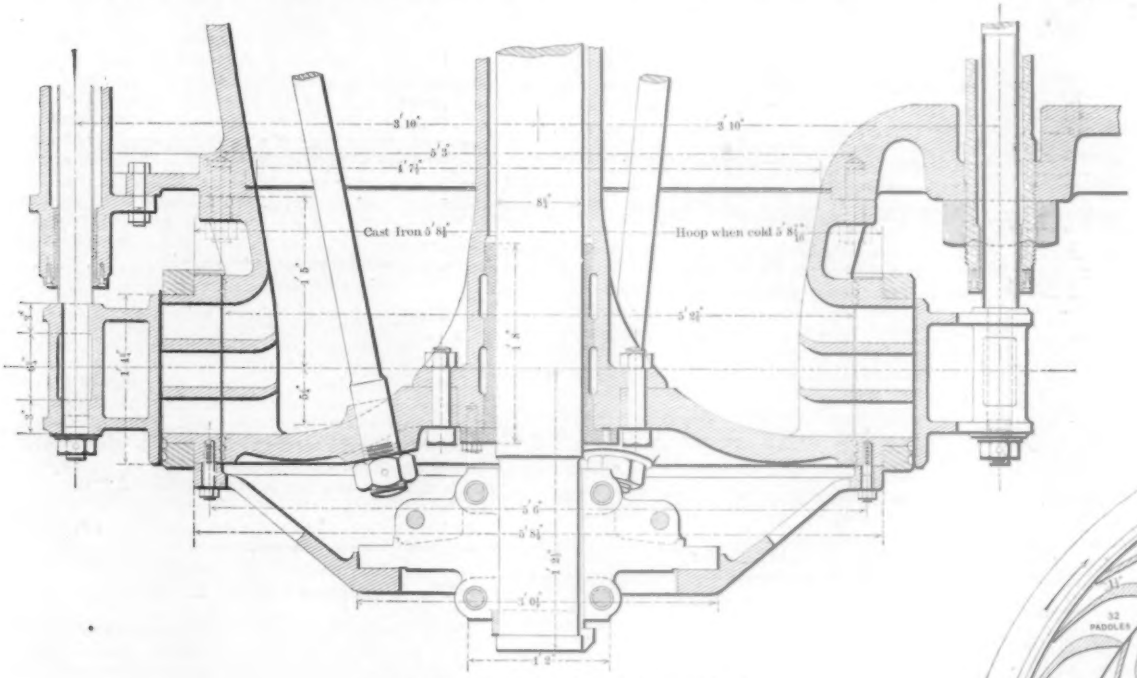


Fig. 7—Vertical Section through Lower Wheel.

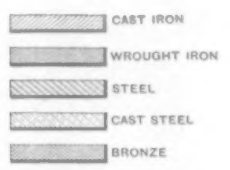


Fig. 9—Index of Materials.

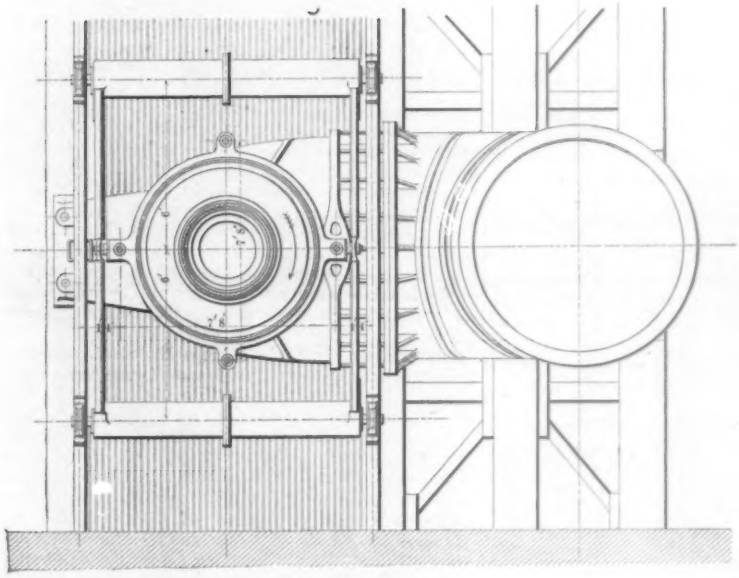


Fig. 8—Plan View of Turbine.

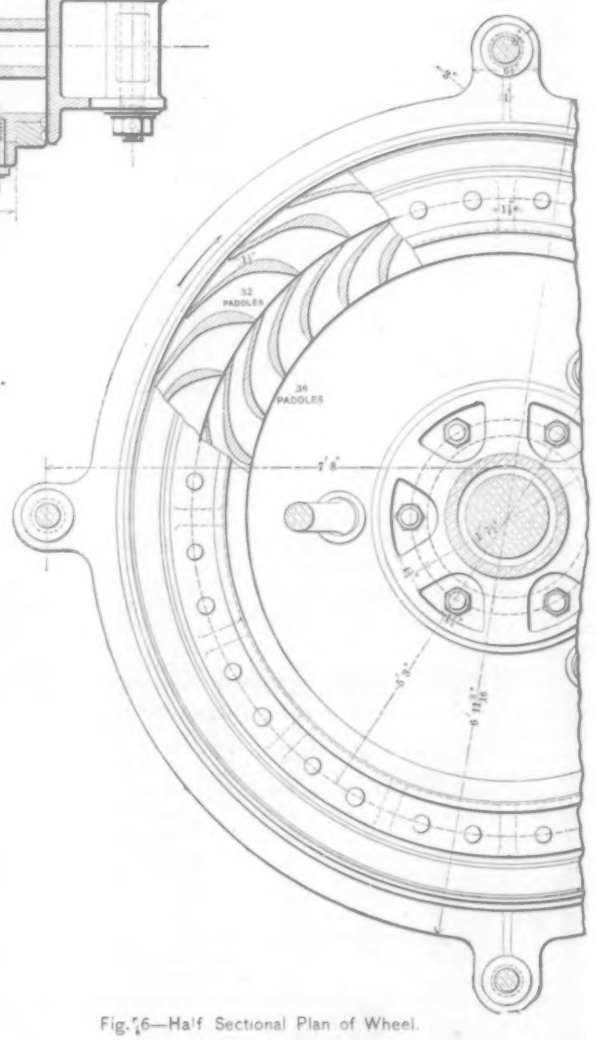


Fig. 6—Half Sectional Plan of Wheel.

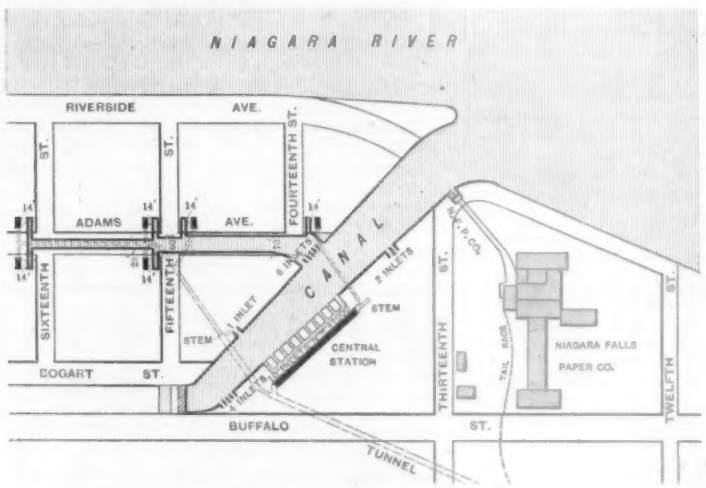


Fig. 1—Sketch of General Plan of Works.

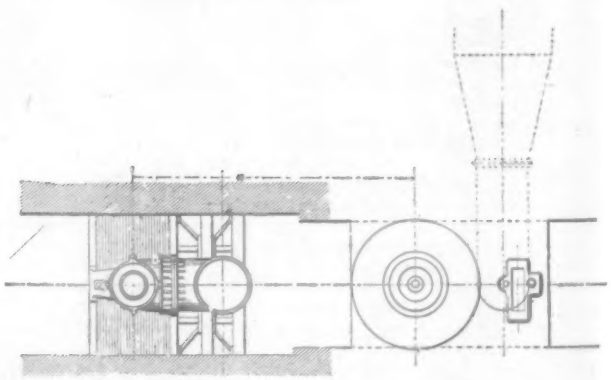


Fig. 4—Sectional View Showing Turbines in Position.

HYDRAULIC MACHINERY AT NIAGARA FALLS—DETAILS OF 5,000-H. P. TURBINES.

recognized the feasibility of the methods proposed and the reliability of those having the matter in charge, they received rates for power which probably makes their annual cost per horse power lower than any other company in the United States which may be said to purchase its power direct.

The First Steps.—The preliminary work, connected with these plans was the examination by E. D. Adams, placed at the disposal of the company at Niagara and the immense power it was desired to develop, there was no precedent found, and, therefore, in a certain sense the work is experimental. Studying the plans employed for the development of 1,000 H. P. is little guide where it is necessary to develop with a fall of 150 ft. over 100,000 H. P. Further than this, a vitally essential part of the question was the transmission of this power after its

of the world. This commission consisted of Sir William Thomson, as President; Prof. E. Mascart, of the College of France, Paris; Col. Theo. Turrettini, of Geneva, who carried out the great works of improvement of the Rhone and Lake at Geneva; Coleman Sellers, Professor of Engineering Practice at Stevens Institute of Technolgy, and W. C. Unwin, Professor of Engineering at the Central Institution of the city and Guilds of London, who

served as secretary to the Commission. This Commission was instructed to call for plans which were to consider the best methods of developing the power, and the best methods for its transmission. The Commission furnished an outline of the work to be accomplished.

1. Unlimited and never failing water, with a comparatively small amount of sediment. 2. Constant net fall of 140 ft. 3. A tail race or tunnel about 6,700 ft. long, with a section 490 ft. square, and a hydraulic gradient of about 7 ft. per 1,000.

The following table gives the names of the several firms who entered plans, an outline of their method of obtaining power, and also of distribution.

It will be seen that the method most favorably considered for the generation of the power was turbine

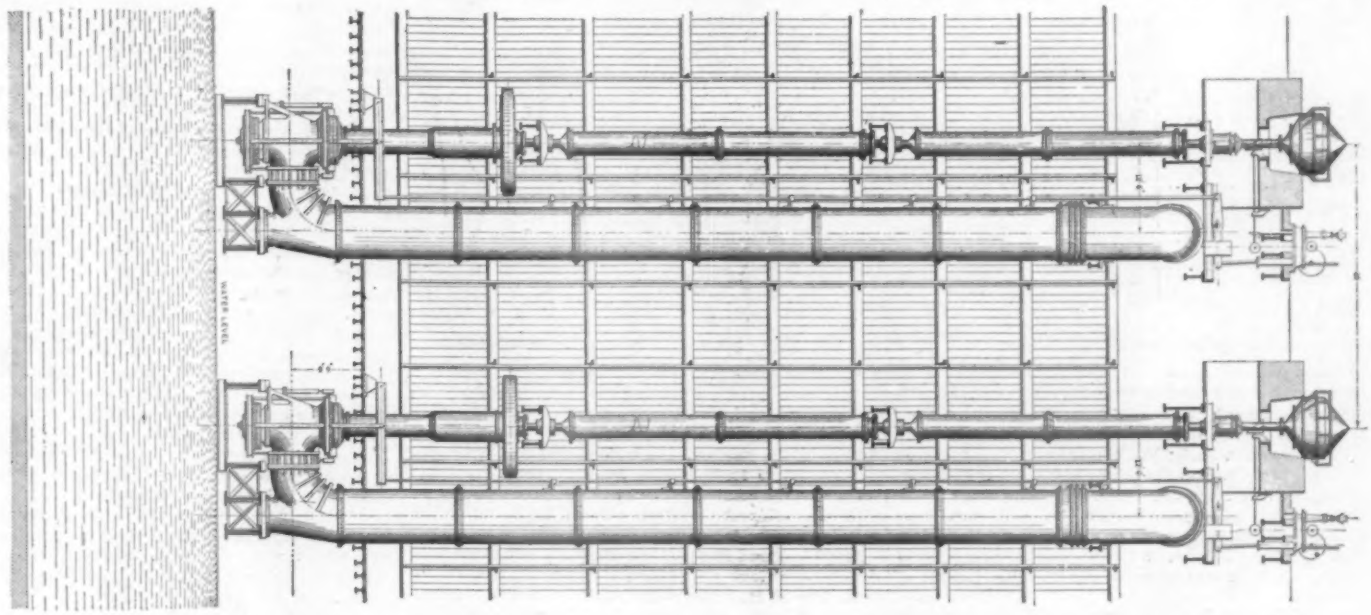


Fig. 2—Vertical Longitudinal Section.

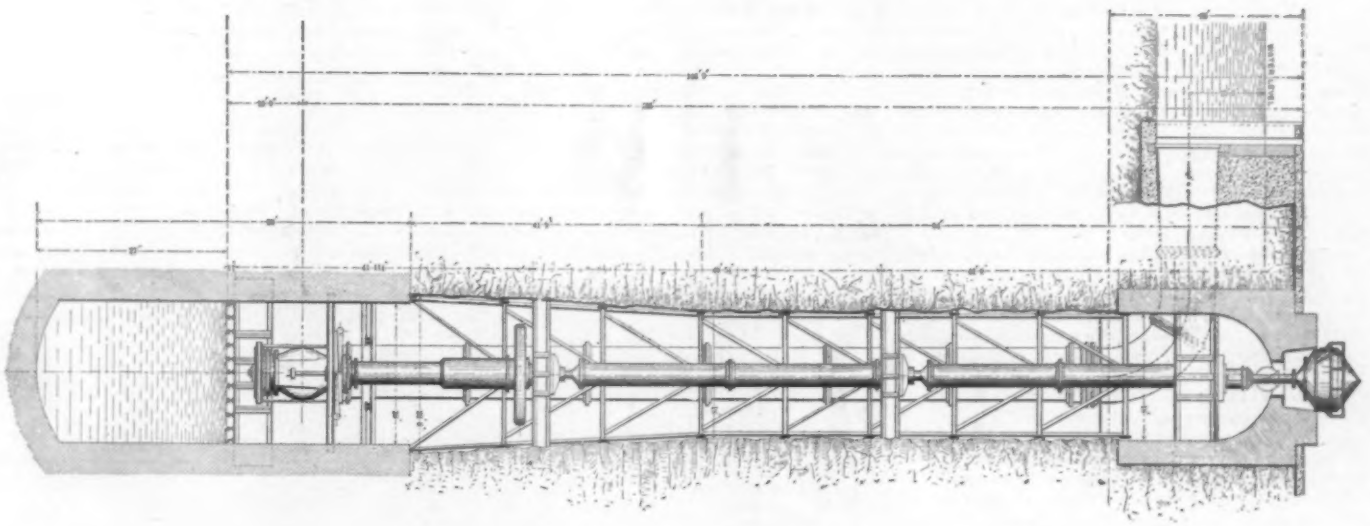


Fig. 3—Vertical Transverse Section.

HYDRAULIC MACHINERY AT NIAGARA FALLS—5,000-H. P. TURBINES.

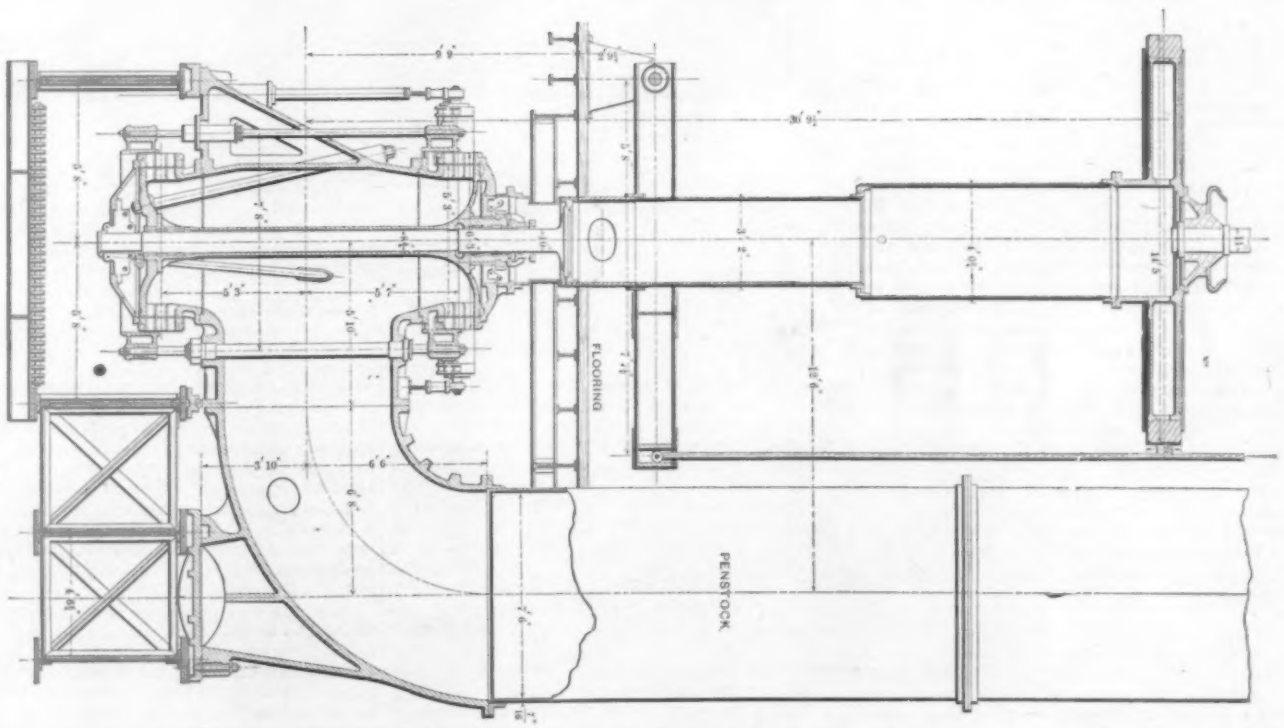


Fig. 5—Longitudinal Section of Turbines.

a. Hydraulic projects for the primary development of power by turbines or other water motors.

b. Projects for the transmission and distribution of power from the primary.

c. Projects combining both development and transmission.

The following data were furnished by the company:

4. About 10 ft. of soil overlies the rock.

Projects were invited for one central station located at the head of the tunnel; for the economical development of as much power as possible; and, finally, for the transmission and distribution of the power overhead, underground, electricity, air, water, cable or other means.

water wheels, the majority of the firms entering plans of this description. In the order of their importance, the methods of distribution were by means of electricity, compressed air and cable transmission.

Awards.—No prize was awarded for any plan combining the development of power and its transmission. One second prize of £500 was divided between two firms

PROJECTS RECEIVED BY THE COMMISSION.

Name.	Generator.	Distribution.
Guenod, Sautter & Co. and Faesch & Piccard	Impulse turbines of 2,500 H. P., with horizontal shafts.	Constant potential dynamos, 1,600 volts.
Guenod, Sautter & Co. and Faesch & Piccard	Impulse turbines of 2,500 H. P., with vertical shafts.	Dynamos 5,000 volts.
Vigreux & Levy	Axial flow turbines of 2,500 H. P., horizontal shafts.	Continuous current dynamos, 5,000 volts.
Hillaret & Bouvier	10,000 H. P. turbines on vertical shafts	10,000 H. P. dynamos, giving 7,000 ampères at 1,000 volts, with motor transformers.
Popp & Riedler	Axial flow pressure turbines of 5,000 H. P.	Multiple stage air compressors, 5,000 H. P. each.
Pearsall	Air compressed in cylinder by direct action of water pressure to 150 lbs. Pressure water is also supplied in same way.	
Lupton & Sturgeon	Inverted flow pressure turbines of 3,750 H. P., with vertical shafts.	Single acting air compressor, delivering air at 5½ atmospheres.
Ganz & Co.	Partial flow impulse turbines 5,000 H. P., with vertical shafts.	Alternate current dynamos, 230 ampères, 10,000 volts.
Escher, Wyss & Co.	Axial flow pressure turbines, vertical shafts, 2,500 to 10,000 H. P.	
Rieler & Co.	Pressure turbine, 2,000 H. P., vertical shaft. Also 2,500 and 5,000 H. P., with horizontal shaft.	Cable transmission.
Vigreux & Feray	Partial admission turbines, 2,503 H. P., horizontal shaft.	Direct driven hydraulic pump, giving 710 lb. pressure.
Pelton Water Wheel Co.	Pelton wheels of 4,000 H. P., horizontal shafts.	Air compressors. Hydraulic pumps. Dynamos.
Forbes	Turbines.	Alternating dynamos, 2,000 volts.
Norwalk Iron Works	Pelton water wheels, 5,000 H. P.	Compressors furnishing air at 147 lbs.

—Faesch & Piccard and Cuenod, Sautter & Co., of Geneva, Switzerland, who acted together. Four third prizes of £200 each were awarded to the following: Hillairet & Bouvier, Paris; V. Popp & Levy, Paris; Pelton Water Wheel Co., San Francisco, and the Norwalk Iron Works Co., of Norwalk, Conn. For the proposals to utilize power, a first prize was granted to Escher, Wyss & Co., of Zurich, and second prizes to Ganz & Co., Budapest; Professor Lupton, of Leeds, and J. Sturgeon, of Leeds. No prize was awarded for the distribution of power.

One of the most important factors was the transmission of power from the bottom of the shaft, where it would be developed, to the top. Evidently the use of turbine wheels of great power called for a correspondingly large vertical shaft, and in order to reduce friction created by the great weight of this shaft, several plans proposed forcing fluid between the bearing surfaces and converting the bearings into so-called fluid bearings. This method was opposed by others, who proposed to so construct the wheels that the water entering them would not only accomplish its work in the turning of the turbine, but also serve to lift the shaft and thereby relieve the bearings of undue friction.

General Aspect.—There is a fall of 326 ft. between Lake Erie and Lake Ontario, most of which occurs in the vicinity of Niagara Falls. The Horseshoe Falls, in the centre of which the international boundary passes, are 158 ft. high and 2,600 ft. wide, the American Falls being 169 ft. high and 1,000 ft. wide. The estimated flow of water is 265,000 cu. ft. per second, and to develop 120,000 H. P. (this was afterward reduced to 100,000 H. P.) with the head of water available, and with an efficiency of 75 per cent. would require 10,200 cu. ft. per second, or less than 4 per cent. of the average flow. As to whether taking this amount from the Falls would be perceptible to the visitor, we have the opinion of John Bogart, formerly State Engineer of New York, that "1½ in. is the probable amount of the mean reduction in depth at the Falls to be caused by the tunnel diversion. In conclusion, it is my opinion that the amount of water that can be taken through this tunnel will not affect the depth of water flowing over the falls to an extent that will be noticeable."

The Canal and Tunnel Works.—Oct. 4, 1890, work was begun on the tunnel, which was finished two years later, or last October. The work contemplated consisted in building about a mile above the falls and canal, having an entrance of about 200 ft. and extending inland about 1,200 ft. as shown in the sketch, fig. 1. This canal is intended to direct the water from the river to several well-pits, the exact location of which is a future consideration, but an idea of which may be obtained from the map. It will be noticed that at the junction of Fourteenth street and Adams avenue there are marked six inlets, these being intended to supply a canal extending along Adams avenue and having pits located as shown, the bottom of these pits being connected with the main tunnel as indicated by the dotted lines. This plan may be changed somewhat as the plan develops, yet it serves to illustrate how the power may be distributed.

The company is now building on the other side of the canal and nearer the inlet and central station in which will immediately be placed two turbines capable of developing 5,000 H.P. each and eight other shafts in which similar wheels will be placed as required, making the total power to be developed at this central station 50,000 H. P.

Leading from the bottom of these shafts in the main tunnel, which extends to a point about 1,000 ft. below the falls, almost directly under the American end of the suspension bridge, this tunnel, of course, serving the purpose of a tail race in removing the water after it has accomplished its work.

The tunnel is horseshoe in section, having a cross-sectional area of 365 ft., and measuring 21 ft. in height by 19 ft. in width. Its entire length is 6,700 ft., the grade being 7 ft. to the 1,000. It is lined throughout with 16 in. of hard brick, this having been found necessary because the rock passed through disintegrated or crumbled quickly when exposed to the air. Specimens of this brickwork taken from the tunnel during the opening of the tunnel leading from the pits of the Niagara Paper Co., the location of which is shown on the map, show that work of an unusually solid character had been performed by the builders. The brick and hydraulic cement had united to form a mass as solid as rock. All this work has been completed, and it now only remains to place the turbines in position, connect them with suitable dynamos and distribute the power.

Five Thousand Horse-Power Turbines.—In the accompanying drawings we present all the principal features of the 5,000 H. P., turbines, the contract for the building of two of which has been let to I. P. Morris & Co., of Philadelphia. The magnitude of these wheels, taken as a whole, the great weights necessary in order to insure the strength required, and the unusual conditions under which they are placed, make them of unusual interest. They were designed by Faesch & Piccard of Geneva, Switzerland, who furnished complete working drawings which were submitted to prominent engineering concerns of this country for bids for building, the contract being let as stated above.

The general arrangement of these turbines in relation to the shaft they are placed in will be seen from figs. 2, 3 and 4 on the accompanying inset sheet. Each turbine operates under an average head of 136 ft., and develops 5,000 H. P., at 250 revolutions per minute. The volume of water passing through each wheel amounts to 430 cu. ft. per second. Each wheel is mounted on a vertical shaft, and is placed at a depth of 141 ft. below water level. It operates a dynamo located at the top of the shaft and the armature of which is coupled directly to the shaft of the turbine. Two bronze wheels, placed one above the other, as shown in fig. 5, are coupled to this shaft. These wheels are shown in detail in figs. 6 and 7, the method of connecting the lower wheel with the shaft being clearly brought out in detail in fig. 7. These wheels are reaction wheels, the water being distributed radially over the interior and over the wheel periphery, being guided to the wheel by 36 paddles, arranged as shown in the sectional plan view of the wheel. This drawing also shows the form of the 32 paddles forming the wheel proper. Thanks to this arrangement, the pressure of the water on the wheels is completely equalized.

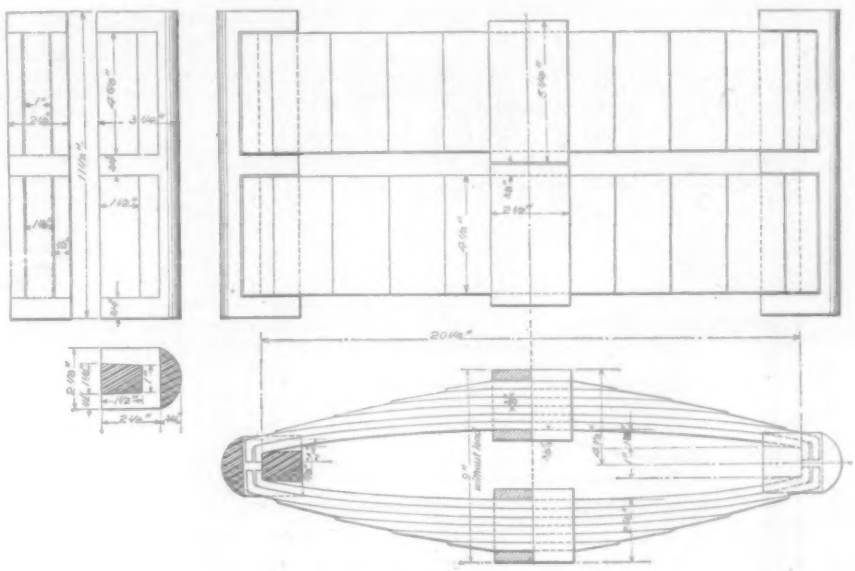
A 7½-ft. vertical plate steel pipe; shown in figs. 2, 3 and 5, conducts the water from the canal to a chamber between the two distributors; thence the water passes through dristributors and the wheels and falls into the tail race leading into the great canal. The main shaft is 135 ft. long, and is made of steel tubes 38 in. in diameter. Eleven-inch solid shafts are interposed at the points where the guides are located. This method of construction makes it possible to considerably diminish the weight of the shaft while increasing its rigidity, and also in reducing the number of guides necessary. In order to insure uniformity in the speed a heavy fly wheel is attached to the shaft, as shown near the lower part in figs. 2 and 3. This wheel is of forged iron, has a diameter of 14½ ft., weighs 10 tons, and has a peripheral speed of 11,000 ft. a minute. The upper bearing of the shaft is, while the turbine is running, completely relieved of its load, because the pressure of the water acts vertically on the lower surface of the upper wheel, and thus balances the considerable weight of the revolving part of the turbine and of the dynamo. All the bearings are provided with automatic lubrication.

The speed is regulated by means of circular guides surrounding the wheels, but having a slight play between them. They have vertical movement, and can thus more or less completely cover the openings and act to throttle, if we may use the term, the discharge of the water. They are completly balanced, as the pressure of water delivered from the wheels acts uniformly on the inner surface. The openings of the wheels and of the distributors are divided into three parts with the object of reducing the efficiency by only a small quantity when the turbines are not running to full capacity, the action of the regulator operating only on one part at a time.

An automatic regulator or governor is placed above ground beside the dynamo and is coupled to this device, which it controls by means of levers, etc. This regulator is of a new type and is patented. It is extremely sensitive to variation in speed and in electrical installation does very good service. The speed varies between a maximum of ¼ per cent. at a normal rate of working and at about 3 per cent. if the capacity of the turbine is increased or diminished suddenly by one quarter. This is a remarkable result for a regulator for a hydraulic motor. The patents on this governor are controlled by the designers of the turbines, Faesch & Piccard.

An Improved Tender Truck Spring.

We illustrate an improved form of tender truck spring which has been patented by Mr Geo. L. Potter, Master Mechanic of the Pennsylvania Co., at Fort Wayne, and which is being used with very satisfactory results on the Pennsylvania lines west of Pittsburgh. The important feature of this spring is the form of the end bearing pieces, which is clearly shown in the illustrations. When



Tender Truck Spring for 3,600-Gallon Tank.

without load the spring bears on the outer edges of the end castings, the length of the spring then being 20¼ in. When the spring is deflected under a load the bearing is gradually transferred to the inner edges of the castings thus reducing the length of the spring to 17¼ in. As the safe load of a spring of this type is inversely proportional to its length, the strength of the spring for heavy loads is increased over 17 per cent. by this means, while at the same time the stiffness of the spring is increased in a much greater degree. The practical result is that the spring is well suited for both heavy and light loads.

The spring shown is intended for tender trucks for 3,600-gallon tanks. Each spring consists of six steel plates 4½ in. wide by ⅝ in. thick. The height of the spring without load is 9 in. The springs used for 3,000-gallon tanks have the same dimensions except that the height without load is 8¼ in., and springs for 2,400-gallon tanks are composed of five plates 4 in. wide and ⅝ in. thick, but are otherwise of the same general dimensions as those previously mentioned.

While this design of spring is used for tender trucks it would seem admirably suited for freight car use and specially for stock cars, as the action of the whole spring is obtained with a light load, giving an easy motion to the car, while when the car is loaded to its full capacity the spring will still be capable of carrying the load easily.

Electric Mining Locomotives.

A new type of electric mining locomotive, especially designed for low and narrow workings, has just been brought out by the General Electric Co., and is designated as the G. L. M. type.

The frame consists of a single heavy box-shaped casting with recesses in the sides for the axle boxes. Space is allowed at one end for the operating platform, and at the other end for the rheostat, the motor being placed in the centre. Recesses are also provided in the frame casting for the brake levers and axle gears.

The motor is of a type similar to the W. P. railroad motor, and consists essentially of two main castings. The lower casting forms the lower pole piece, and supports the bearings for the armature shaft, the two intermediate shafts (placed one on each side of the armature) and the field spool. The gears are set in pockets in the frame of the motor, and are completely and tightly covered by the iron castings, thus doing away with the separate gear cases. The top pole piece is part of the upper casting of the motor, and is of such shape as to make a complete cover for the motor, thoroughly protecting the armature, field spool and other interior parts. The armature itself is of the ironclad ring type, with all the latest improvements that have been shown advisable in railroad practice. The intermediate shafts, two in number, are placed one on each side of the armature, and transmit power directly to both axles.

It is claimed that this construction offers the following advantages:

The armature being geared to two intermediate shafts on opposite sides, the thrusts of the gears tend to neutralize each other so that the resultant pressure on the armature bearings is very slight. The parallel connecting rods on the axles being dispensed with render it possible to largely decrease the width of the machine. The construction also permits a spring suspension for the whole machine, motor included. The axle boxes are on the outside and are easy of access for oiling, or for the removal and replacement of the linings.

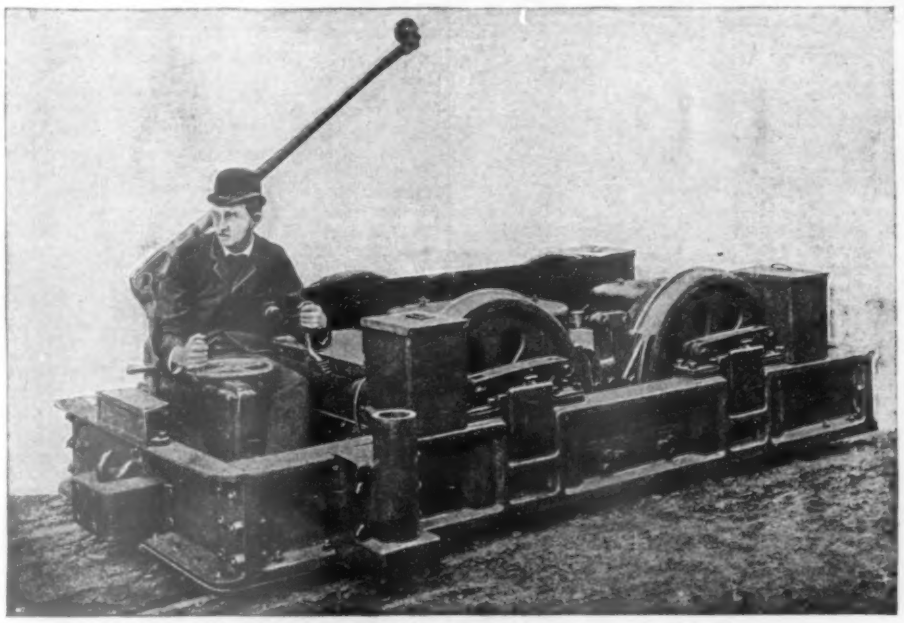
The locomotive is equipped with a new form of trolley, so insulated that the operator may take hold of it at any part except at the wheel. In case it is necessary to move the trolley wire from one side of the drive or entry to the other, the trolley may be lifted entire from its socket, and placed in a corresponding socket on the opposite side of the locomotive. All connections are automatically made by simply setting the trolley in place. The rheostat used is of the standard railway type provided with a special fitting. The brake is a very powerful form of toggle joint made of substantial steel castings. Easy means are provided for the adjustment or renewal of the brake shoes.

All of the working parts of the locomotive are well covered and protected from injury.

The following are some of the general dimensions of the 30-6 and 30-10 locomotives made for a 30-in. gauge:

Tractive force at drawbar	3,000 l. s.
Speed	6 or 10 miles per hour.
Length over all	9 ft. 6 in.
Total height	36 in.
Width over all	48 "
Wheel base	40 "
Gauge	30 "
Diam. of wheels	28 "
Weight	15,000 lbs.

The same type of machine is made of different capacities, the tractive force at drawbar varying from 750 to 4,500 lbs.



Electric Mining Locomotive.

Made by the GENERAL ELECTRIC COMPANY, *New York.*

The Lansberg Brake.

Dec. 17 the Lansberg Brake Co. received an order for 2,800 complete quick-action freight-car brakes. The capacity of the works will be at once increased.

A Pacific Cable.

Proposals have been submitted, in a form which seems to imply serious business, to construct a cable service to Australasia, via the Pacific. The idea has of course, been long mooted. Queensland has never been reconciled to the construction of the land line of 2,000 miles through the heart of Australia by the splendid enterprise of South Australia, which, at a cost of nearly half a million sterling, connected Adelaide with Port Darwin, the terminus of the Eastern Extension Co.'s cable system. Queensland was ambitious to construct the land link with the company's cable, via the eastern coast and Cardwell, to the Gulf of Carpentaria. But the energy of South Australia, combined with the ignorance which prevailed as to the route from Port Darwin to the Roper River, induced the company to give the preference to the project of the southern colony.

The idea of an alternative cable, via the Pacific, has long exercised a fascination over the minds of certain enterprising gentlemen in Canada and England. The Pacific Telegraph Company was accordingly registered with a nominal capital of £2,000,000. Though this was not subscribed then or since, the company submitted proposals to the Colonial Conference which assembled in London early in 1887 for the construction of a cable from Vancouver Island to Australia, touching at Hawaii, Fanning Island, Samoa, Fiji and New Zealand; and, in return for a guarantee from the governments of Great Britain, Canada and the Australian colonies, of traffic to the amount of £75,000 per annum for 25 years, they agreed to grant a cable rate of 4s. per word for both government and public messages, and to make further reductions if the estimates of increased traffic were realized. The proposal has not advanced much beyond the region of discussion. Mr. Sanford Fleming, C.M.G., of Canada, has been one of the strongest advocates of the alternative line, largely on the ground that it would pass mainly through British possessions.

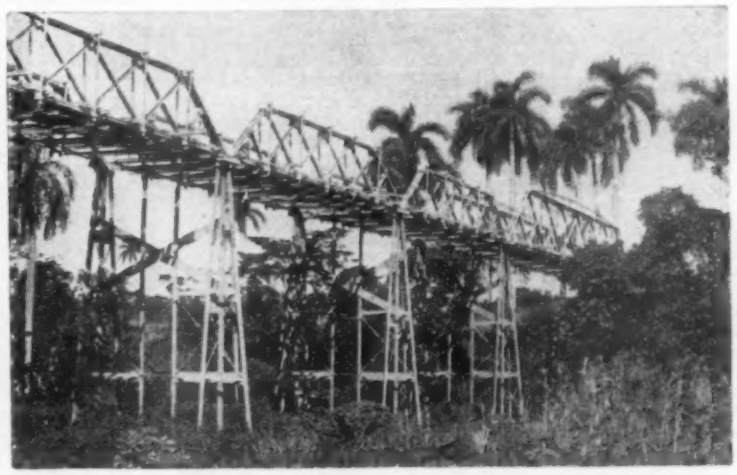


Fig. 1—A Bridge of Old Rails.

But the proposals which are now made, and which seemed destined to bear fruit, are of French origin. The Société Française des Telegraphes Sous-Marin, has undertaken to lay, within 18 months, a cable establishing communication between Queensland and New Caledonia. The two colonies which must primarily benefit from the construction of the line to New Caledonia are Queensland and New South Wales, the former being only 900 miles distant, and the latter having already extensive commercial relations with the French penal settlement. The Governments of these colonies appear to have readily acquiesced in the proposal that they should each guarantee the French company £2,000 a year on condition that the French Government guaranteed £8,000 a year for 30 years; the company, in their turn, undertaking to lay, maintain, and work the line, allowing the guarantors the free use of the section for Government messages up to the extent of their guarantee in each year of the period referred to. It was further agreed that the working expenses should not exceed £2,400 a year, and that the receipts over and above that amount should go towards the annual reduction of the guarantee of £12,000, to be shared at the rate of one sixth for Queensland, one-sixth for New South Wales, and two-thirds for the Government of France. Though the matter has been kept decidedly quiet considering the magnitude of the political and commercial interests involved, confirmation has been obtained in Paris of the accuracy of the above details. The French Government admit that they are parties to the contract, and it is anticipated that the guarantee of £8,000 a year will be ratified by the Chamber of Deputies next month, and very possibly the Submarine Company will receive other help from them besides. But in any event the company have sufficient faith in their enterprise to proceed with it whether the French Government assist them or not. Indeed, they have announced their willingness to continue succeeding sections of the main Pacific cable with all possible dispatch. They are even ready to begin to lay the Fiji section at the same time as the line to New Caledonia if a guarantee can be arranged, and also to couple up the Hawaiian Archipelago. It is said that the complete scheme contemplates a cable to Vancouver or San Francisco.

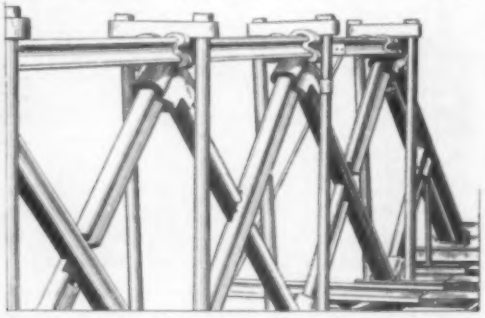


Fig. 3—Some Details of Connections.

A Railroad Bridge Built of Old Rails.

BY EDUARDO J. CHIBAS, C. E.

The bridge shown in fig. 1 is built of old 60-lb. rails and is on the line of the railroad at the Soledad sugar estate, near Guantañamo, in the eastern part of the island of Cuba, over which thousands of tons of sugar cane are yearly transported from the fields to the sugar factory.

Fig. 2.—A Bridge of Old Rails.

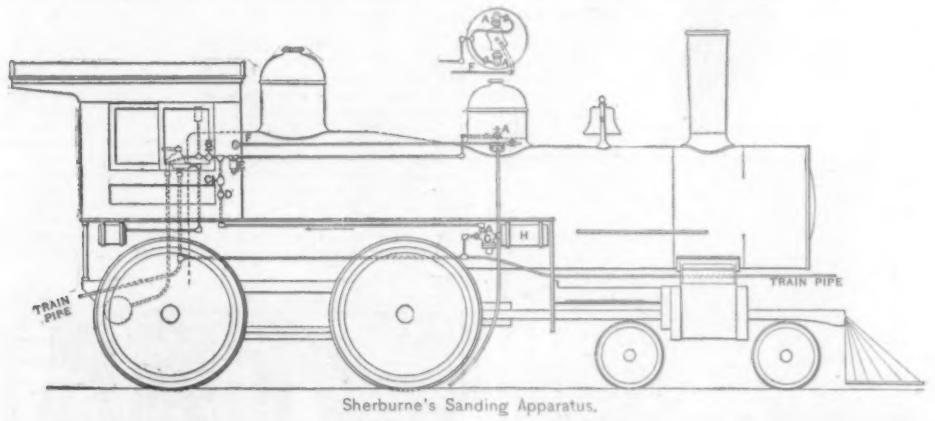
It is of Howe truss type with inclined end-posts which are composed of two rails. The upper and lower chords also consist of two rails placed side by side and with sufficient clearance between them to allow the braces and counters, which are made of single rails, to go between them. The vertical tie rods of wrought iron are the only members for which rails were not used. The floor beams consist of rails placed in pairs resting on the lower chords, to which they are held by U-shaped bolts.

The joints are all of cast iron and were the most troublesome and expensive part of the work on account of the difficulties in making the patterns required. There are two spans of 16 ft., eight of 36 ft. and one of 72 ft., making an aggregate length of 392 ft. They were built in 1888, at the Guantañamo Railroad shop, by the

then Master Mechanic Mr. Walter S. Phelps, of New Jersey. The various spans were erected at the shop and taken to the bridge site on flat cars. Fig. 2 represents the 72-ft. span on the way to its final resting place. The towers vary in height from 15 to 30 ft. and the posts are also of old rails. Fig. 3 shows some of the connections.

A New Track-Sanding Apparatus.

We illustrate a novel track-sanding apparatus which has been devised by Mr. C. W. Sherburne, of Boston. The general principle of the automatic feature is the introduction of a Westinghouse triple valve and auxiliary reservoir, which are shown at *G* and *H* in the illustration, by means of which sand is automatically discharged on the rails whenever the air brake is applied, making the driver-brake more effective. This automatic action is accomplished by closing the valve *B* and opening the valve *C* sufficiently to give the desired amount of sand whenever the brake is applied. Further than this, the air jet can be used for distributing sand at any time by means of the valve *B*, which furnishes the direct connection to the main air reservoir, the valve *C* being closed under these circumstances. In addition to this, the usual sand lever *F* is retained and operates the same as usual. The directions for operating this apparatus state that the moisture trap *E* should be opened at least once a day. *D* is a line check, seating toward the



Sherburne's Sanding Apparatus.

triple valve. It is said that the quantity of sand used, when connected with the brake, is about 1½ buckets in 100 miles.

When Should a Locomotive Be Destroyed?*

The profitable age to which a locomotive can be maintained to is an open question, and varies with circumstances, as changes in weight and capacity must enter largely into the problem. The Pennsylvania, the pioneer road to commence destroying locomotives, is still running engines more than 20 years of age, because this class, while not so heavy as a modern engine, has 20 × 24 in. cylinders.

This subject cannot, and perhaps should not, be looked at entirely from the standpoint of the motive power department; but power ought to be furnished for the transportation of freight at the least cost to the company. In order to do this there is a point reached in the *condition* of every locomotive when he must decide whether it is worth rebuilding. Many are rebuilt when they ought to be scrapped, simply because the management will stand a heavy outlay for necessary repairs where they would not listen to a proposition to renew through a builder.

An engine that has been in active service hauling freight for twelve years comes to shop and has to receive new firebox and one flue-sheet, new cab, cylinders, tender cistern and tires. Air pump, driver brakes, and very likely some new driving axles are applied, the whole repairs to cost $3,000. The boiler is swung out of frames, and after flues are out and inside of boiler is cleaned, you find that one sheet in the boiler looks bad, thin in some places, and in another narrow, longitudinal grooves worn in sheet. However, you feel that boiler is safe after it stands the hydraulic pressure. Your firebox is put in, and you look with some pride upon the work, but your boiler maker will probably spoil your good feeling by remarking:

"Yes, it's a good job, but that throat-sheet," then he will wag his head.

"Well, what's the matter? Isn't that all right?"

"Yes, it is all right *for a while*, but it is only going to be a short time before that will have to be renewed."

You leave the boiler and go over into the blacksmith shop, where one of the frames is being straightened, and you find a crack has developed in heating the frame. You have this remedied by welding, and instruct them to bring in the other frame and examine that. And so you go. Whichever way you turn the engine is showing unexpected weakness, and you wonder whether your $3,000 estimate is going to hold out.

Time goes on and the engine goes into service. Say that it is satisfactory and you are getting good work, and it runs without mishap for a year or perhaps 18 months, when the engine comes to shop for repairs.

About the time this engine was turned out of shop a new engine was bought and put on the road. She comes into the shop for repairs at the same time. You look over the expenses during the past year, and you find this engine which you had repaired so thoroughly has cost a great deal more than the new one for running repairs. You give both engines the repairs they need, and find the cost of the new one $250, while upon the other engine you are lucky if it does not reach $1,000 or $1,200.

Probably every motive power man in this club has had a similar experience, and the figures will be found to conform closely to practice.

The next year these two engines will come to the shop again, and the new one will cost $600, and the one rebuilt, "as good as new," another $1,200.

Suppose a road has two engines, one of them 12 years old and the other new, making the same mileage, what would it cost to keep them in repairs for eight years? Call the old engine No. 1 and the new one No. 2.

The value of the old engine as scrap would be $800, and it will cost for repairs $3,000, making her cost you ready for service, $3,800. The new engine cost $9,000. Taking it by years, the account would stand about as follows:

	No. 1, repairs.	No. 2, repairs.
1st year	$1,000	$250
2d "	1,200	600
3d "	1,500	1,000
4th "	3,000	1,800
5th "	2,000	1,500
6th "	2,000	1,800
7th "	2,500	1,800
8th "	2,500	2,000
First cost	3,800	9,000
	$19,500	$19,550

This estimate shows that one locomotive, at the end of eight years has, including its price, cost you $19,550. The older engine has cost $15,700 for repairs alone. The older engine if sold eight years before would have realized at least $800; so that, practically, one engine eight years old and one twenty years old, have cost about the same, as far as your department is concerned. At the outset the company have invested $9,000, and the interest of this amount during the eight years would amount to, say $4,952.50, as against $3,830, the interest on cost of repairs to the old engine. But the new engine has been hauling upon an average four more cars per train than the older engine. The value of this additional service would certainly be far in excess of amount of interest on the money invested.

It would be folly to say that an engine should run a certain number of years and then be destroyed, for some engines at 15 years of age are worth more than others at eight. The *condition* and worth of the individual engine must decide that, but I do believe that many roads are maintaining engines that it would be economy to destroy. At the same time I cannot help wondering whether some engines are not destroyed that it would be economy to repair.

A modern freight road cannot afford to haul trains with light 16-inch engines even if new; and therefore it must be a great loss to spend $20,000 in rebuilding unsuitable engines for eight years of inferior service.

* Paper by Alonzo Dolbeer, Superintendent of Motive Power of the Buffalo, Rochester & Pittsburgh Railway, read at the meeting of the New York Railroad Club, Dec. 15, at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street.

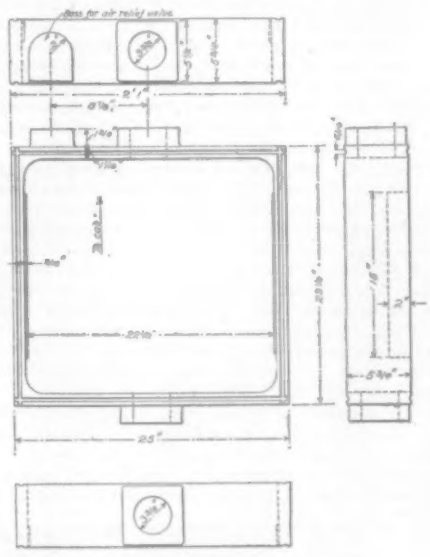
High Pressure Steam Chest for Dean Compound Locomotive.

We illustrate the high pressure steam chest and steam chest cover for the latest Dean compound locomotive, the more important details of which were published in the *Railroad Gazette*, Nov. 25. The steam chest casting is of Eureka steel, the sides being 1 1/16 in. in thickness. The steam chest cover, which is shown in detail, is of cast iron and is strengthened by five longitudinal ribs ¾ in. thick and 2⅜ in. deep, which connect the upper and lower plates of the casting. The converting valve, which was illustrated in a previous issue, is bolted to the centre of the steam chest cover and is connected with the interior of the chest by means of the cored passages between the stiffening ribs, as shown. A safety valve 1¼ in. in diameter, set to lift at 210 lbs., is placed on the steam chest cover. The top of the casting is covered with sheet iron, and the space between the latter and the casting, 1¼ in. deep, is filled with non-conducting material.

The Annual Report of the Interstate Commerce Commission.

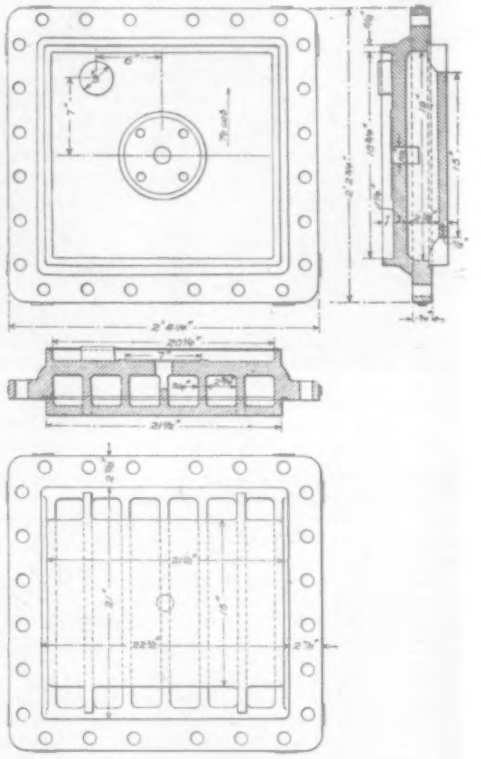
The sixth annual report of the Interstate Commerce Commission has been transmitted to Congress and an abstract has been given out for publication. The report reviews the reasons which led to the passage of that Act, which was a compromise measure between diverging theories and conflicting interests. It is held that the results of the Act have been of value in correcting public sentiment, restraining injustices, and enforcing reasonable charges and equal treatment. Judicial interpretation has limited the meaning of the law and ascribed to it an intent not contemplated when it was passed, but the effect of these decisions has been greatly exaggerated. They have not invalidated the essential features nor condemned the general principles of the Act, but have weakened the means of enforcing it.

A brief review is made of cases disposed of during the year and the fact is pointed out that consideration of these cases involves the formulation of principles oftentimes bearing upon the business of the entire country. By way of illustration, the case of rates to Boston is cited, which by the Commission's order are now required to be a percentage of New York rates, instead of being arrived at by fixed arbitraries. Another case is that of the sugar rates to Fargo; and another is the recent one decided in favor of the city of Spokane. In this case the



Eureka Steel Casting.

Commission decided that the defendants are justified by water competition, in making lower rates to Pacific coast terminals than to Spokane, but held that the Spokane rates were unreasonable and directed a reduction of 18 per cent. Another important recent decision, is the one construing the long-and-short-haul clause, in which it is held that ordinary competition does not justify higher charges for the short than for the long haul.



Cover—Cast Iron.

High Pressure Steam Chest—Dean Compound Locomotive.

Cases in the United States courts which have grown out of decisions and investigations made by the Commission, are also reviewed. These include the import rate case in which Judge Wallace sustained the Commission against the Texas & Pacific Railway, ruling that from the port of entry to interior points rates shall be the same on import and domestic shipments. The orange rate case is also mentioned. In this the Commission decided that through lines from Florida must make a reduction of at least five cents a box on oranges to northern cities, and must refund that amount to shippers who have been charged the unreasonable rate heretofore made. By a decision of the Circuit Court of the Northern District of Florida, the defendants were enjoined from further disobeying the order of the Commission, thus sustaining the right of the Commission to fix maximum reasonable rates. In the case of the Com-

mission against the Atchison system, involving greater rates for the short haul to San Bernardino than for the long haul to Los Angeles, the Circuit Court of the Southern District of California decided, that water competition justified the lower rates for the short haul. The decision of the Circuit Court in the Southern District of Illinois, in a case where an indictment was found for transporting flour to Montreal at less than interior rates, that Congress has no jurisdiction over rates outside the country, is commented upon, and the embarrassment caused by the ruling is pointed out. Three convictions for false weighing have been had in Missouri, and sentence is to be passed this month. In Chicago an acquittal has been had in one criminal case, and other indictments have been withdrawn, because of inability to produce proofs of the violations on the ground that under the Counselman decision witnesses could not be compelled to testify.

The report next takes up some cases originating in United States Courts. It will be remembered that in the case of the Oregon Short Line against the Northern Pacific, Judge Field held that a railroad is not required to receive and haul cars of other companies and pay car mileage when it has cars of its own available. From this view Judge Deady dissented and the Commission inclines to the view expressed by him. The recent opinion of Judge Brewer to the effect that the total joint rate of two roads is over an independent line from the lines formed by either road, and not to be considered in determining the local rate of either road, is discussed in the report, and alleged to be without foundation, either in the debates in congress, or in the practice of carriers since the law was passed, or in the rulings of the Commission. The Commission holds that the joint line has authority to make rates as low as, but not lower than, the intermediate rates of the constituent roads. It is also held that the principle that the share of the joint rate is not comparable with the local rate is well settled. The total rates, joint or individual, are the proper standard by which to determine the legality of intermediate rates. This decision of Judge Brewer, and an application of the same doctrine by a district Judge in Kansas, give the independent line doctrine the force of law for the time being, and Congress is urged to take immediate action to give legislative construction to the word "line" in the Act.

Pending amendments are discussed at considerable length. One is to compel publication and filing of joint tariffs for interstate traffic before such traffic can be carried at any other than local rates. Another is, to make railroads or other corporations subject to the act liable to indictment for criminal offenses under the act. As it now stands, penalties are imposed exclusively upon officers and agents, while the corporation goes free. The decision of the Supreme Court in the Counselman case has made it impossible to successfully prosecute violations of law where the evidence must be procured from parties who are implicated. A bill to amend the revised statutes so as to remove this embarrassment is pending. Several other important amendments are recommended, and attention is called to the fact that they are not intended to alter or amend the prohibitive sections of the statute, but to repair the machinery provided for compelling obedience to it.

Finally, the Commission takes up the proposed amendment to the fifth section, to permit pooling. After considerable inquiry the Commission concludes that there has been some change of opinion with regard to the prohibition of pooling during the past five years, but it also concludes that it would be vain to protect carriers from attacks upon each other, if the general public cannot be protected from the greater evils of discrimination, extortion, undue preference, etc. If the law is to be amended, the two classes of amendments should go hand in hand. The Commission would therefore oppose any modification of the anti-pooling case unless the several amendments that it has recommended be engrafted in the law. "Until the law is made as strong as its framers intended in the matters of fair and stable rates, equal treatment and suppression of favoritism, it is idle to seek to protect carriers whose immunity under authoritative construction of the law from restrictions intended by Congress, seems one of the remarkable facts in current history."

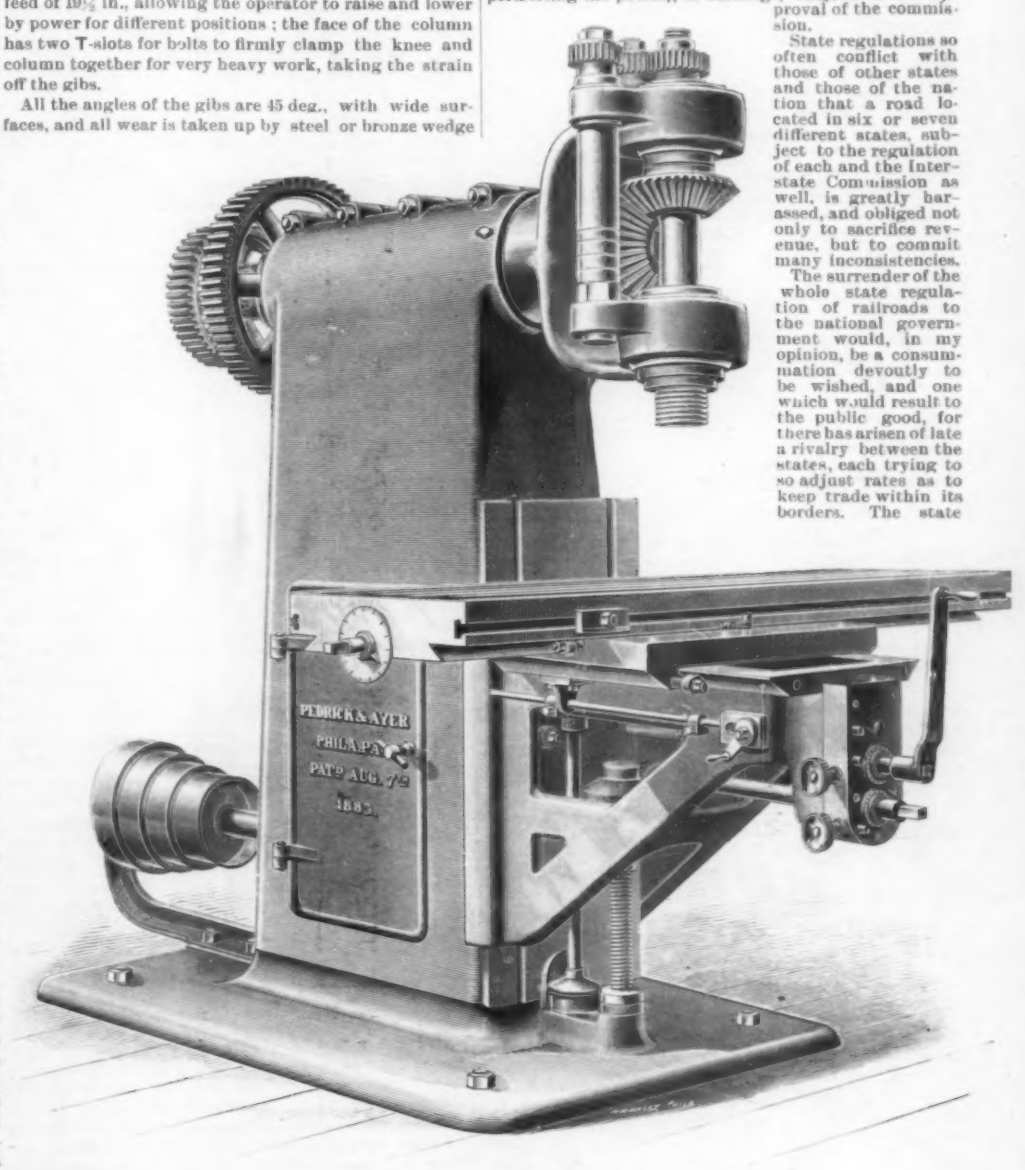
Heavy Vertical Milling Machine.

The accompanying engraving represents a specially powerful and heavy machine, designed for railroad work, and recently introduced by Messrs. Pedrick & Ayer, of Philadelphia.

This machine is designed for doing a great variety of heavy work, face milling, circular or profile work, rack cutting, etc. The head is graduated, and can be set in any position of a circle. It has a locking device when set as a vertical machine. The shank of this swivel head is 8 in. diameter, and is firmly clamped in position by the four bolts on top of machine. The driving shaft running through it is 2½ in. diameter, with self-oiling bearings lined with bronze; the main spindle is 3⅝ in. diameter, and 6⅝ in. long at lower journal, and 2⅛ in. diameter and 5⅝ in. long at upper journal, having a taper hole in it 12 in. long, 2 in. at large end and 1⅝ in. at small end, with 1⅛ in. hole through it for driving ont arbors, etc. The end of spindle is threaded to receive large inserted face mills. The machine is driven by a four-step cone, largest diameter of which is 13 ins. and smallest 7 in., for 3¾" in. belt; it is back geared 4 to 1; the back gears are operated by a clutch similar to some screw machines. It has eight speeds and 32 changes of feed, with 2 in. belt.

The platen is 14 in. wide and 48 in. long, with automatic feed in either direction, fed by a screw with a clutch nut, which allows the screw to revolve without moving the table. By connecting the end of the screw by gearing, a circular motion can be imparted to a circular attachment placed on the table. The table and plate have a movement on top to and from the face of column of 12 in., with automatic feed and automatic stops, which are very essential when cutting racks, etc. It has also a power up and down feed of 19½ in., allowing the operator to raise and lower by power for different positions; the face of the column has two T-slots for bolts to firmly clamp the knee and column together for very heavy work, taking the strain off the gibs.

All the angles of the gibs are 45 deg., with wide surfaces, and all wear is taken up by steel or bronze wedge gibs, and are adjusted by studs and nuts from the end, and by an ingenious method are oiled, so that in moving the oil is not scraped off. All small mitre gears and clutches of feed are made and cut from bar steel; dials on all feeds read to one one thousandth of an inch. The weight of machine is about 4,500 pounds.



Heavy Vertical Milling Machine.

Made by Messrs. PEDRICK & AYER, *Philadelphia, Pa.*

E. P. Ripley on the Interstate Commerce Law.*

Possibly some of the stronger roads have not been seriously injured, but, as a whole, the working of the law has, I believe, inflicted great injury on the roads, and in many cases the injury has fallen heaviest on those roads that most strictly complied with the law's provisions. To a considerable extent the ambiguity of the law itself is responsible for the injury, but the plain provisions of some sections are unnecessarily hurtful to the carriers, and at the same time absolutely valueless to the public as a protection from so-called corporate greed.

Both the community and the railroads were especially fortunate in the personnel of the first commission as appointed by President Cleveland. That body proceeded slowly and carefully in the decision of the various perplexing questions at once presented to it, and in the first two years of its existence really formulated some valuable dicta and settled some intricate questions which have essentially passed into railroad law with cheerful acquiescence of both the public and the railroads. Not that they were always correct in their conclusions, but they were dispassionate and impartial, and succeeded in the main in arriving at the facts and at just conclusions, and commanded the respect of all parties concerned. . . . The commission should be retained but the law repealed. Four years ago I would also have added that it should not be replaced by anything else, but I am not so sure of this. I can conceive the possibility of a national law simple and brief, administered by a commission selected without regard to political considerations, which might be productive of great good. Such a law should only provide that there shall be no unjust discrimination as between persons and places, and that the commission shall pass upon complaints. (Its findings would be subject to review by the courts). Perhaps this is only reiterating a common law principle, but it provides a tribunal of presumable ability and some technical knowledge, and for one I should rather leave such questions in the first instance to the decision of such a board than to a court. Such a law, having thus protected the public, should also protect the railroads (and the public as well) by permitting the pooling of earnings, subject to the approval of the commission.

State regulations so often conflict with those of other states and those of the nation that a road located in six or seven different states, subject to the regulation of each and the Interstate Commission as well, is greatly harassed, and obliged not only to sacrifice revenue, but to commit many inconsistencies.

The surrender of the whole state regulation of railroads to the national government would, in my opinion, be a consummation devoutly to be wished, and one which would result to the public good, for there has arisen of late a rivalry between the states, each trying to so adjust rates as to keep trade within its borders. The state of Iowa has been notably active in the endeavor to make its neighboring states support its railroads, while adjusting railroad rates in such a manner as to seriously interfere with interstate commerce by forcing its citizens to purchase of state merchants, and this results to the disadvantage of the citizen by depriving him of competing markets. The present interstate law should be repealed. It was ill digested, and has not been a success, though assisted by an able commission. It has not benefited the community. Most of the railroads have obeyed it as well as they could; those that have observed it best have, perhaps, suffered most.

* Interview in the Chicago *Inter-Ocean*, Dec. 19.

The Madras Harbor Works.

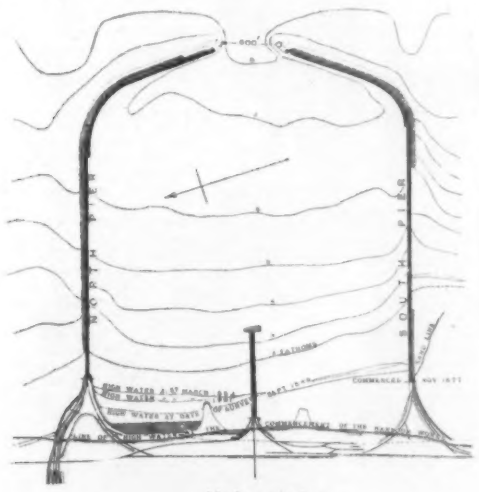
Indian Engineering, for Aug. 20, contains an interesting report of the progress made on this work during the official year 1891-1892, and also a chart showing the changes that have taken place in the shore contours due to the construction of the harbor pier.

The Madras roadstead, like the whole line of the coast of western India, is liable to be swept periodically by hurricanes of great violence. One of the most destructive of these occurred in May, 1872, during which the registered wind pressure reached a maximum of 53 lbs. per square foot. In 1881 another of these periodic cyclones seriously damaged the new harbor works then under construction.

This project is of especial interest to American engineers as an example of successful construction of piers in depths of over 40 ft., and of establishing a deep water harbor in the open sea on an unprotected coast. These

harbor works consist of two piers 3,000 ft. apart, which extend seaward, normal to the shore, 2,800 ft., and then curve about 75 deg. each, across the harbor front and terminate in pier heads 500 ft. apart, forming the harbor entrance. The pier walls are built of massive concrete blocks on rubble foundation. The outer portions of the piers, where subjected to heavy wave action, have wave-breakers of rubble protected with concrete, about 40 ft. wide, along the base of the walls to break the force of the waves against the superstructure and prevent undermining.

Work on this project was commenced in 1876, and at present about 100 ft. of each of the pier-heads and about 800 ft. of the rubble base protection remains uncompleted During the construction, previous to the building of the walls across the front of the harbor, the shore line between the piers advanced seaward about 400 ft., but since these walls became effective no change has taken place in the harbor contours except a deepening of about 2 ft. in the harbor entrance between the pier-heads.



Madras Harbor.

The resultant movement of the sand drift is from south to north, and up to the present time has caused an advance seaward of the shoreline, south of the harbor, about 1,500 ft. and a recession of 150 ft. north of the piers. This result is very important when considered in reference to the project now being advocated for the construction of a deep water harbor on the gulf coast by building a breakwater connected with the shore by an open trestle work. In this case the sand drift, instead of being arrested by solid harbor piers, will pass through the open trestle into the harbor; and as this sand movement is the resultant of the combined action of the littoral currents and wave disturbance, it becomes necessary to consider what the result may be when the drift material is carried inside the area protected by the breakwater.

Barnes Friction Clutch Pulleys.

The illustration shows a late improvement in clutch pulleys and cut-off couplings made by the J. H. & D. Lake Co., of Hornellsville, N. Y. Fig. 1 is a longitudinal section of the screw lever friction pulley in released position, showing the driving hub keyed to the shaft.

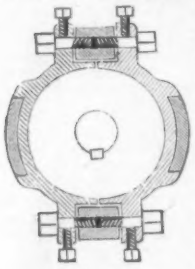


Fig. 2.

Fig. 2 is a cross section showing friction hub encircled by friction ring; the former of which is cast in one solid piece with the pulleys. Projecting lugs on opposite sides of the driving hub of the ring drop into lugs, or lug cavities, of the friction ring, and when the clutch is on these lugs take all the driving power. This is an improvement over the bolt fastening system.

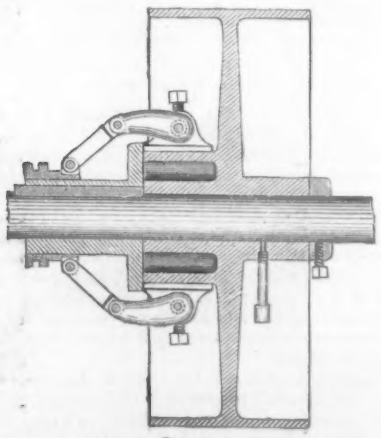


Fig. 1.

At the top and bottom of fig. 2 is shown a device which avoids the use of much complicated detail. It is a lever nut on each side of the friction ring, one-half of the nut being cut with a right thread and the other half with a left thread. Sufficient space between opposite sections of the ring is given for clutch, which is effected by means of right and left thread screw bolts entering the lever nut from opposite sides, secured by set screws. Duplex levers are attached to these nuts at their upper section and to the hub at their lower section. When the shipper sleeve is thrown against the flange by the operating lever, the duplex lever turns the nut sufficiently to produce the requisite friction. The screw bolts are adjustable to any desired pressure. They give the pulley a positive grip and absolute release from the hub by each opposite shift of the operating lever, with out the use of springs.

The Hercules Boiler Scale Remover.

This is a simple automatic device for feeding kerosene oil into steam boilers by the drop. Kerosene oil has long been known as effectually removing and preventing the formation of scale, but hitherto it could not be administered in sufficiently minute quantities to insure absolute safety to the boilers and still accomplish the desired purpose. This machine gives the boiler a regulated allowance, claimed to be sufficient to remove all existing scale and prevent further formation, and it is further claimed that the use of this compound will not injure boilers or connections, and will neither cause foaming or start joints.

The Hercules Boiler Scale Remover.

The machine is constructed on the principle of a sight feed lubricator and therefore requires little attention beyond filling and occasionally regulating. The inventor's explanation of the rationale of the operation of the kerosene is that it has the property of spreading in a film over the surface of wrought iron, flaking off rust or any other adhering substance, and that kerosene will dissolve sulphate of lime after it has hardened and hold it in solution until the boiler is blown off. When first used in a boiler a considerable quantity of oil is generally needed to detach the old scale which requires to be washed out and removed, after which it is stated that a pint a day is sufficient to keep a 100 N.H.P. stationary boiler clear.

This device has been considerably used on stationary boilers and is undergoing a test on a locomotive boiler on the New York, Pennsylvania & Ohio.

Train Accidents in the United States in November.

COLLISIONS.

REAR.

2d, on Northern Pacific, near Pasco Junction, Wash., a freight train, which had been stopped in consequence of running over a hand car, was run into at the rear by a following freight, wrecking the caboose and one car of wheat. The wreck took fire and two cars and a bridge were burnt up. Two drovers in the caboose were killed.

2d, on Boston & Maine, at St. Johnsbury, Vt., a freight train ran over a misplaced switch and into the rear of a passenger train standing on the side track, killing 1 passenger, the only one in the train.

3d, on Philadelphia & Reading, near Pencoyd, Pa., a passenger train ran into the rear of a preceding freight, killing 2 passengers and injuring 1 trainman. It is said that the brakeman of the freight had flagged the passenger train and boarded it.

7th, on Cincinnati, Jackson & Mackinaw, near Greenville, O., a passenger train running at considerable speed struck the caboose of a gravel train standing on the main track and wrecked the caboose and loaded gravel cars. The passenger engine went down a bank. A brakeman in the caboose was killed, an engineer, fireman and 20 passengers injured. The engine of the gravel train had gone some distance to the station to get coal, and while in the yard was derailed and thus delayed. The brakeman who was killed should have flagged the passenger train, but it is said he was asleep in the caboose.

7th, 2 a. m., on Southern Pacific, near Lovelock, Nev., a passenger train ran into the rear of a preceding freight, wrecking the caboose and 2 freight cars, which took fire and were burned up. The freight had broken apart on a descending grade and the rear portion eluded control and ran back. The conductor of the freight was injured.

9th, 6 p. m., on Chicago, Milwaukee & St. Paul, at Highland, Ia., a local freight train standing at the station was run into at the rear by a through freight, wrecking the caboose of the local, in which were several passengers. The caboose was telescoped with the car next ahead of it, and 4 of the passengers were pinioned in the wreck and burned to death, the wreck catching fire at once from the stove and lamps in the caboose; 3 passengers were injured. The through freight approached on a straight line; the weather was clear, and the red tail lights of the local were burning brightly; witnesses say that these lights must have been clearly visible for two miles.

10th, on Baltimore & Ohio, at Laughlin, Pa., a local passenger train was run into at the rear by an express passenger, badly damaging 1 car and the engine. The rear brakeman of the local train, who was standing on the rear platform swinging his red light, was killed. It is said that the accommodation train was on time and just starting away from the station; that the express was two hours late and that its conductor had just observed that the train was too close upon the preceding train, and had pulled the bell rope just before the collision occurred.

13th, on New York Central & Hudson River, at Batavia, N. Y., a heavy freight train ran over a misplaced switch and into some cars standing on the side track, wrecking 7 of them and injuring a switch tender. Fire broke out and part of the wreck was burned up.

13th, on Chicago, Milwaukee & St. Paul, at Tunnel City, Wis., east bound fast mail train No. 9 ran into the rear of the preceding freight, wrecking the caboose and several cars, which took fire and were mostly burned up. Three men riding in the caboose were injured. The wreck occurred in a tunnel.

14th, on Pittsburgh, Ft. Wayne & Chicago, near Lima, O., a freight engine approaching the rear of a freight train ahead of it for the purpose of pushing it up a grade was not properly controlled and collided with the caboose so violently as to damage several cars. A brakeman was injured.

15th, on International & Great Northern, near Paso, Tex., a freight train ran into the rear of a preceding freight which had been unexpectedly stopped, badly damaging the engine and several cars. The enginemat of the foremost train, who was under his engine making repairs, was badly injured.

16th, 9:30 p. m., on Pennsylvania road, at Allegrippus Pa., a freight descending a steep grade became uncontrollable, and ran into the rear of a preceding freight, wrecking 20 cars and injuring 3 brakemen, one of them fatally. Both tracks were blocked all night.

18th, on Lehigh Valley, at Lost Creek, Pa., a locomotive ran into the rear of a passenger train which had been stopped by a derailed freight train, derailing a passenger car which fell down a bank; engineer, fireman and several passengers injured. It is said that the rear brakeman had been out with a flag, but was called in, preparatory to starting the train, just before the collision occurred.

18th, on West Jersey, near Glassboro, N. J., a freight train broke in two and the rear portion afterward ran against the forward one, wrecking several cars. A brakeman was injured by jumping.

18th, on Baltimore & Ohio, at Clarksburg, W. Va., a passenger train ran over a misplaced switch and into some freight cars, damaging the engine and causing the death of the engineer.

20th, on Belt Line at Archer avenue, Chicago, a freight train which was preparing to stop at a crossing was run into at the rear by a following freight, wrecking the caboose and 4 cars. Three trainmen were killed and 2 badly injured.

22d, 4 p. m., on Missouri, Kansas & Texas, near Reams, I. T., a stock train ran into the rear of a work train standing on the main track, making a considerable wreck and injuring 3 trainmen. It is said that the stock train had been flagged and had reduced speed, but that as the flag was some distance from the work train and around a curve, the speed had been again increased.

23d, on New York & New England, at Hop River, Conn., a passenger train ran into the rear of a freight train, doing considerable damage. The passenger engineer was injured by jumping. It is said that the flagman of the freight did not go out far enough.

25th, on New Orleans & Northeastern, near Laurel, Miss., a freight train which had unexpectedly stopped on the road was run into at the rear by a following freight, wrecking the engine, caboose and 11 cars. A tramp was killed and the engineer and fireman injured. There was considerable fog at the time.

27th, on Fitchburg road, near Ashburnham, Mass., a newspaper train ran into the rear of a freight train, wrecking the caboose and 1 car. A freight brakeman was killed and the conductor and another brakeman injured.

29th, 2 a. m., on Delaware, Lackawanna & Western, near Greene, N. Y., a freight train ran into the rear of a preceding freight, injuring the engineer and 1 brakeman.

29th, on New York, New Haven & Hartford, near Noank, Conn., an east-bound passenger train, which had been stopped to repair a broken coupling, was run into at the rear by a following freight, damaging the engine and rear car. This car, a dining car, took fire, from some cause not yet determined, and was burned up. Two men on the freight train were injured by jumping. It appears that the flagman of the passenger train did not go back far enough.

29th, on Georgia Railroad, at Sparta, Ga., a passenger train ran over a misplaced switch and ran into the rear of a freight train standing on the side track, wrecking several cars and badly damaging the locomotive. The fireman was injured.

30th, on Pennsylvania road, near Glen Loch, Pa., an east-bound freight train ran into the rear of a preceding freight, wrecking several cars and fouling the west-bound track. A west-bound freight train ran into the wreck and several cars were thrown down a bank. The engineer of the latter train was injured.

And 30 others on 26 roads involving 12 passenger and 34 freight and other trains.

BUTTING.

1st, on Chicago Great Western, near Aiken, Ill., butting collision between a freight and a work train, making a bad wreck. Three trainmen were killed and several others injured.

2d, on Little Rock & Ft. Smith, near Cabin Creek, Ark., butting collision of freight trains, causing the death of 1 engineer and 1 brakeman. It is said that an operator failed to deliver an order to one of the trains.

7th, on Wabash road, near St. Louis, Mo., a construction train standing in a short tunnel was run into at the front by a freight train, wrecking 12 cars. A fireman was killed and 2 other trainmen injured. It is said that the men in charge of the work train understood that the freight was not to be run on that day.

8th, on Denver & Rio Grande, near Del Norte, Col., butting collision between a mixed train and a freight, making a considerable wreck and injuring an engineer and fireman.

9th, on Baltimore & Ohio Southwestern, near Rayesville, O., butting collision of freight trains, causing the death of one of the engineers.

10th, on Missouri Pacific, at Pleasant Hill, Mo., butting collision between a south bound passenger and a north bound freight train, wrecking both engines and several cars. A mail agent and 6 passengers were injured.

10th, on Wisconsin Central, near Colfax, Wis., butting collision of freight trains, wrecking both engines and several cars. One fireman was killed and a brakeman injured.

10th, on Louisville, New Orleans & Texas, near Bobo, Miss., butting collision of freight trains, killing the engineer and firemen of one of the trains. The wreck took fire and 8 cars were burned up. It is said that the south bound train was running 10 minutes ahead of time.

15th, 6:30 p. m., on Pittsburgh, Fort Wayne & Chicago, at Nevada, O., west bound passenger train No. 7 ran into the head of a freight train which was preparing to back into a side track, badly damaging both engines and several cars and wrecking a baggage car; both engineers and a tramp injured.

17th, on Wabash road, at Monticello, Ill., butting collision of freight trains, badly damaging both engines and wrecking 2 cars of cattle. One engineer was injured. It is said that a train order was misunderstood.

21st, on Illinois Central, at Rockford, Ill., butting collision of freight trains badly damaged both engines and injured one engineer. An overhead bridge was damaged.

22d, 6:30 a. m., on Union Pacific, at Alda, Neb., a fast passenger train ran over a misplaced switch, and into the head of a freight train standing on the side track, wrecking both engines, two baggage cars, and several freight cars. Both engineers, both firemen, and two freight trainmen were killed, and three other trainmen injured. It is said that there was considerable fog at the time.

22d, on Central of Georgia, near Vaughn's, Ga., a butting collision of freight trains caused the death of one trainman, and the injury of several others.

22d, 12:30 p. m., on New Orleans & Northeastern, near Poplarville, Miss., butting collision between a south bound passenger and a north bound freight train, badly damaging both engines, a baggage car and 5 freight cars. Two boys stealing a ride on the baggage car were killed and several passengers injured. It is said that the passenger train disregarded a meeting order.

22d, on Buffalo, Roche-ter & Pittsburgh, near Hutchings, Pa., a butting collision of freight trains resulted in the death of 1 brakeman.

29th, on Norfolk & Western, near Blackstone, Va., a butting collision of freight trains wrecked both engines and a large number of cars. A fireman was injured.

30th, on East Tennessee, Virginia & Georgia, near Johnson City, Tenn., butting collision of freight trains, wrecking both engines and a number of cars. A man stealing a ride was killed.

And 7 others on 6 roads involving 2 passenger and 12 freight and other trains.

CROSSING AND MISCELLANEOUS.

3rd, on Philadelphia, Wilmington & Baltimore, near Oxford, Pa., collision of freight trains, making a considerable wreck, which was mostly burned up by fire which was started by coal from the firebox of one of the locomotives. One engineer was injured.

4th, on Chicago Great Western, at Lilly Lake, Ill., a portion of a freight train became uncontrollable and ran down a grade into the head of another freight train killing a conductor and injuring 2 other trainmen. It is said that the runaway was caused by the brakemen all going into the caboose and leaving the cars unattended.

8th, on New York Central & Hudson River, at Suspension Bridge, N. Y., a Michigan Central passenger train backing through the Y ran into a Rome, Watertown & Ogdensburgh passenger train, damaging several cars and injuring three passengers and a trainman. It is said that a switch was misplaced just before the train ran upon it.

11th, on Missouri Pacific, at Greeley, Kan., collision between a passenger train and a freight train, killing one passenger and injuring another.

14th, at East Buffalo, N. Y., a freight train of the Delaware, Lackawanna & Western ran into a freight train of the New York, Chicago & St. Louis, at the crossing of the two roads, making a bad wreck, one locomotive being overturned and 10 cars ditched. One employé was killed and two badly injured.

17th, on Delaware, Lackawanna & Western, near Campbell's, N. Y., a freight train broke apart in two places and the foremost portion when being set back collided with the middle part, doing considerable damage and injuring the engineer and fireman, who were thrown from the engine.

21st, on Chicago, Milwaukee & St. Paul, near Everly, Ia., collision between a freight train and the rear portion of a preceding freight which had been left standing on or near a heavy grade, and had been started backward, when no brakeman was upon it, by the wind. The wreck was a bad one and the caboose and several cars were burned up. Five bridgemen were sleeping in the caboose; 1 was killed, 1 badly injured and the others less severely hurt.

22nd, on New York & New England, near Norwood, Mass., a special train, carrying the railroad commissioners, ran into a switch engine and a car, both of which were overturned. A brakeman of the switcher was injured.

23d, at Walkerton, Ind., a freight train of the Baltimore & Ohio ran into a passenger train of the Lake Erie & Western, at the crossing of two roads, badly damaging the baggage and smoking cars, the latter of which was overturned and and set on fire. The engineer and fireman of the freight were injured.

25th, 3 a. m., on Pittsburgh, Cincinnati, Chicago & St. Louis, near Richmond, Ind., an eastbound freight train became stalled on an ascending grade, and several cars were cut off and left standing on the main track while the forward portion went ahead to a side track. A westbound freight train, waiting at the side track, started out as soon as the eastbound had cleared the switch, assuming that the entire train had passed. There was no light on the standing cars, and the engine ran into and wrecked six of them. The fireman was killed, and the engineer and 1 brakeman badly injured.

25th, on Chicago & Northwestern, near Manchester, S. D., a collision of a freight train resulted in the injury of an engineer and a fireman.

28th, on Delaware, Lackawanna & Western, near Stroudsburg, Pa., a collision of freight trains badly damaged both engines; 1 engineer was injured.

29th, on Chicago & Northeastern, in Milwaukee, Wis., a passenger train ran into a switching engine, badly damaging both engines and injuring the engineer and 2 passengers.

29th, on Chicago, Burlington & Quincy, at Iowa Falls, Ia., collision between a passenger and a freight train, badly damaging both engines and injuring 1 passenger.

And 14 others on 14 roads, involving 6 passenger and 22 freight and other trains.

DERAILMENTS.

DEFECTS OF ROAD.

3d, on Cincinnati, Saginaw & Mackinaw, near West Bay City, Mich., a freight train was derailed at a defective switch and 7 cars were wrecked; conductor and 1 brakeman injured.

7th, on Union Pacific, Denver & Gulf, at Melvin, Col., a coal train was derailed by the spreading of rails and 2 cars were overturned. Two men stealing a ride on one of the cars were buried several hours under the coal, but were got out alive and not very badly hurt.

15th, 5 a. m., on Baltimore & Ohio, near Grafton, W. Va., west bound train No. 7 was derailed by a broken splice bar while running at considerable speed, overturning 1 car and badly damaging several others. One trainman was injured.

24th, on Houston & Texas Central, near Prairie View, Tex., passenger train No 4 was derailed by a defective frog. Two passengers were injured.

29th, on Southern California, at Monrovia, Cal., a passenger train was derailed and most of it thrown into a ditch. The engineer and mail agent were injured. It is said that the track was weakened by a heavy rain.

30th, on St. Louis, Iron Mountain & Southern, near Arkansas City, Ark., a passenger train was derailed and 1 passenger car fell down the bank, which was overturned and wrecked. Twelve passengers were injured, 2 of them probably fatally. It is said that the rails spread.

And 8 others on 8 roads, involving 3 passenger and 5 other trains.

DEFECTS OF EQUIPMENT.

2nd, on Pennsylvania, Poughkeepsie & Boston, at Portland, Pa., a freight train was derailed by the breaking of a journal and 7 loaded cars were wrecked; 1 trainman was injured.

2nd, 1 a. m., on Pittsburgh, Fort Wayne & Chicago, at Allegheny City, Pa., a freight train was derailed by a broken axle and several cars thrown upon the opposite main track. An east bound express train came along at the same time and ran into the wreck, and a west bound express soon after ran into the rear of the freight. Both of the passenger engines were damaged and 1 engineer and 1 firemen were injured.

4th, on Baltimore & Ohio Southwestern, near Chillicothe, O., a freight train was derailed by the breaking of a car and 21 cars were wrecked; a brakeman was killed.

7th on Georgia, Carolina & Northern, at Gloster, Ga., the caboose of a freight train was derailed by a broken drawbar which fell upon the track; the caboose was overturned and the conductor killed.

10th on Lehigh Valley, near Wilkes Barre, Pa., 15 cars of a freight train were derailed by a broken wheel, blocking the road 16 hours. A tramp stealing a ride was killed.

12th, on New York, Lake Erie & Western, near Narrowsburg, N. Y., several cars of a freight train were derailed by a fallen brakebeam, injuring a drover riding in the caboose.

17th, on Atlantic & Pacific, near Hackberry, Ariz., 5 cars of a passenger train were derailed by the breaking of a wheel, most of the train going down a bank and 2 sleeping cars falling through a trestle. One passenger was killed and 13 injured.

20th, on Chicago, Milwaukee & St. Paul, near Wabasha, Minn., a passenger train was derailed by a broken wheel and several cars thrown down a bank. Two passengers were injured.

And 7 others on 6 roads, involving 2 passengers and 5 freight trains.

NEGLIGENCE IN OPERATING.

17th, on Vandalia line, at Belleville, Ind., an eastbound express train, which was 50 minutes late and running at high speed, was derailed at a point where track repairers had a frog and several rails out. The engine and three cars were ditched. The engineer was slightly injured by jumping. The flagman had been sent out to stop trains but deserted his post. The cars of the train were vestibuled, and it is said that this was undoubtedly an important element in preventing injury to passengers.

And 9 others on 7 roads, involving 2 passenger and 7 freight and other trains.

UNFORESEEN OBSTRUCTIONS.

6th, on Missouri, Kansas & Texas, at Mazie, I. T., a freight train was derailed by running over a cow, and the engine and 17 cars went into the ditch; engineer killed and 2 trainmen and a trespasser injured.

14th, on Baltimore & Ohio, near Uniontown, Pa., a freight train was derailed by running over a cow and 35 cars ditched, many of them being completely wrecked; 2 brakemen were injured.

16th, on Mobile & Girard, near Guerrytown, Ala., the engine of a freight train was derailed and overturned by running into a hand car, 3 cars being wrecked; engineer and firemen injured.

18th, on Union Pacific (narrow gauge line), near Kenosha, Col., a passenger train of four cars was blown off the track by a high wind and lodged in a ditch. Of the 40 passengers on the train 11 were injured. The locomotive remained on the track, the baggage car in overturning breaking the coupling.

20th, on Western & Atlantic, near Atlanta, Ga., the engine and four cars of a freight train were derailed by an obstruction maliciously placed on the track; engineer and fireman injured.

And 4 others on 4 roads, involving 2 passenger and 2 other trains.

UNEXPLAINED.

1st, on Atchison, Topeka & Santa Fé, near Trinidad, Col., a freight train was derailed and several cars went into the ditch. A tramp stealing a ride was killed.

1st, on Central Branch, at Farmington, Kan., a freight train running on a side track was derailed and the engine ran against the engine of another freight, standing on the main track, making a bad wreck; 1 tender was overturned and an engineer and fireman were killed.

11th, on Northern Pacific, near Post Falls, Idaho, a mixed train was derailed and all of the cars, 2 freight, 1 baggage and 1 passenger were ditched. Two passengers were injured.

14th, on Southern Pacific, near Houston, Tex., a car in a passenger train was derailed at a frog and overturned, 1 passenger being injured.

18th, on Delaware, Lackawanna & Western, at Elmira, N. Y., a tender and baggage car of a passenger train were derailed, injuring the conductor and baggage man.

20th, on East Tennessee, Virginia & Georgia, near Jackson, Ala., a passenger train was derailed and the whole of it, except the engine, went down a bank. The passenger car took fire, but the flames were extinguished. Of the 30 passengers on the train only 1 was seriously injured.

20th, on Mobile & Birmingham, near Mobile, Ala., a circus train was derailed, injuring 7 circus men.

25th, on Ft. Worth & Denver, at Decatur, Tex., the engine of a freight train was derailed and the engineer and fireman injured.

28th, on West Shore, near Canastota, N. Y., an east bound freight train was derailed, fouling the west bound track; a west bound freight train came along immediately after and was derailed, several cars being wrecked. A tramp was injured.

And 27 others on 26 roads, involving 5 passenger and 22 freight and other trains.

OTHER ACCIDENTS.

11th, on Central of Georgia, near Tennille, Ga., the locomotive of a freight train was wrecked by the explosion of the boiler, killing the engineer and 1 brakeman.

14th, on Philadelphia & Reading, near Schuylkill Haven, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler, and 6 employés killed.

15th, on Philadelphia, Reading & New England, on the high bridge at Poughkeepsie, N. Y., the roof of a car in a freight train was blown off by a violent wind, badly injuring a brakeman, who fell with the roof, but lodged on the footwalk of the bridge.

23rd, on Utah & Northern, at Market Lake, Idaho, the engine of a passenger train was badly damaged by the breaking of a side rod; the fireman was injured.

26th, on Knoxville, Cumberland Gap & Louisville, ne Washburn, Tenn., the paymaster's car, attached to passenger train, was badly damaged by the explosion the heater. The car accountant, who was in the ca was fatally injured and another man less severely hur

30th, on Lehigh Valley, at Shenandoah, Pa., the engine of a coal train was wrecked by the explosion of its boiler and the engineer killed. Two other trainmen were injured.

And 3 others on 3 roads, involving 2 passenger and 1 other train.

A summary will be found in another column.

State Railroad Commissioners' Report.

IOWA.

The Railroad Commissioners of Iowa, Spencer Smith, John W. Luke and Peter A. Dey, have made the 15th annaul report of the Board, for the year ending June 30 last, but including the investigations and decisions made by the Board up to Dec. 1. A large part of the report is taken up with decisions of the State Supreme Court affecting the powers of the Board. There is also a list of 31 cases which have been brought in the state courts by the Attorney General to enforce orders of the Commision, which cases are still pending.

The statistics presented in the report are largely those covering the whole of the lines of the companies reporting, and are therefore of no particular value, being for territory having no definite limits; and the information for Iowa proper either consists of estimates or is incomplete on account of the refusal of some of the important roads to give the desired information. We copy such of the statistics as seem to be of general interest:

Number of locomotives reported	4,048
Equipped with Westinghouse brake	3,765
Number of passenger cars reported	3,024
Equipped with Janney coupler	905
Equipped with Janney and Miller	349
Total number of freight cars reported	125,446
Equipped with Westinghouse brakes	25 839
Equipped with M. C. B. couplers	27,811
Length of road in Iowa, miles	8,497
Second track, miles	163
New railroad built during the year, miles	5
Taxes paid in Iowa during the year	$1,279,907
Employés in Iowa reported	30,192
Estimated number not reported	300
Employés killed	80
Employés injured	587
Passengers killed (in train accidents)	23
Passengers injured	65
Trespassers killed	57
Trespassers injured	49
Other persons killed	19
Other persons injured	75

The first eight items are *not* for Iowa alone.

Iowa has a coupler law, requiring new and repaired cars to have automatic couplers and making the use of cars not equipped illegal after Jan. 1, 1898.

The Commissioners call attention to the fact that the companies reporting have paid for taxes (not all in Iowa, by any means) a sum equal to 45 per cent. of the amount paid by them in dividends on stock.

NORTH CAROLINA.

Advance sheets of this report have been given out. The letter to the Governor, which opens the report, suggests the question whether the Legislature, in creating the Commission, intended that it should have power to fix tariffs. Under the terms of the present law the Commission decides that it has no such power. The report shows that there are now 3,593 miles of railroad in operation in the state. During the year 114¼ miles were put in operation, of the assessed value of $582,000. There was an increase over the 1891 assessment of $405,000. In 1890 the assessed value of railroad property was $12,321,000; in 1891, $18,423,000; in 1892, $19,726,000; these figures being round numbers.

The report shows for the year:

Passengers killed	21
Passengers injured	55
Employés killed	30
Employés injured	276
Trespassers killed	54
Trespassers injured	39
Others killed	1
Others injured	3

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Senator Cullom has introduced in the Senate two more bills to amend the Interstate Commerce law, and two or three other members have also introduced bills. Representative Lind, of Minnesota, is preparing a bill to provide for uniform classification of freight, which is to be reported next week. It is said to be "conservative" in its provisions. We are curious to see this bill, and hundreds of railroad men will be glad to know how to carry out this hitherto impossible scheme. If the law is "conservative" enough to be workable, we fear that its conservativeness will be so severe as to freeze it to death. Representative Wise, of Virginia, has introduced a bill intended to cure the weakness of the 12th section of the Interstate Commerce law which was recently the subject of a decision by Judge Gresham at Chicago. Senator Peffer, of Kansas, announces his purpose of strenuously opposing the Cullom bill to permit pooling and to abolish the law prescribing imprisonment. One of Senator Cullom's new bills, introduced this week, is to compel witnesses to testify, and the other is to define the word "line" as used in the Interstate Commerce law. It is declared to mean a physical line, and the provisions of the bill generally are in line with the common sense view of the Interstate Commerce law and the view adopted in the decisions of the Commission. This bill is to meet the difficulty presented by the decision of Judge Brewer in the Chicago & Northwestern case.

The Interstate Commerce Commission on Pooling.

We had hoped and rather expected that the Interstate Commerce Commission would recommend an amendment to the Interstate Commerce Law to permit pooling. We have known for several years that some of the members of the original Commission held, with the best informed railroad officers, and with the great majority of those who by broad study and observation are most competent to judge, that the quickest, the easiest and the surest way to get equal and stable rates, and to prevent discriminations, is by pools. That is, by such agreements among railroad companies that they can control each other, and yet compete within the bounds of law and reason. Those members of the Commission who accepted this view, which has become almost an axiom, have, as we believe, held back from urging it upon Congress because they did not think that public opinion was yet ripe for it But public opinion has changed a good deal since March 4, 1887; as the Commission says "it is manifest that there has been some change of opinion upon this question in the past five years." This is putting the fact very mildly, at any rate. There has been not only "some," but a decided change and such a stanch advocate of government regulation and determined champion of the public as Senator Cullom, now brings in a bill to amend the laws that permit pooling.

We had supposed that the Commission, too, had read the handwriting on the wall; but obviously, it has not. It not only does not recommend any modification of the anti pooling clause, but would oppose it unless it is coupled with various amendments that the Commission has recommended which are designed to increase the power of the Commission and which have nothing to do with pooling. The Commission says:

"The attempt to secure the public from discrimination, extortion, favoritism, undue preference and undue prejudice, and to secure to every citizen just and reasonable rates and equal and exact treatment in all transportation matters, is the very essence, spirit, and purpose of the law, and it would be vain to protect carriers from competitive attacks upon each other, if the general public connot be protected from the greater evils above enumerated."

True, but we hold, and many others hold, that the railroads can and will secure the public from just these evils if they are permitted to, but that they are now mostly helpless. That is the "very essence, spirit and purpose" of the argument, but the Commission ignores it entirely.

So it is clear that a repeal of the anti-pooling clause must be passed, not with the help of the Commission, but against its opposition. This is a pity; the Commission could have put itself into line with what seems to be the inevitable course of events, and might have helped on the cause of good railroading. It is a great deal easier to lead than to drive; and when the Commission ceases to regard the railroad companies as the natural enemies of society, and starts from the theory that the interests of the carrier and the shipper are in the long run identical, and that the Interstate Commerce Act should be administered for the protection of both, its power for good will be immensely increased.

In fact, conditions have changed very much in the last 12 or 15 years. The theories held by railroad officers of their relations to the state and to the public have undergone a great, perhaps we might say a radical change. They have learned not only the legal and moral wrong but the bad policy of a great many things that they used to do as a matter of course. Generally speaking, the views now held by reputable officers of high rank as to secret rebates, favoritism and all vicious discrimination are enlightened. This has come about by an educational process in which the Interstate Commerce Law has been a useful, but quite recent, influence. Now the question is how can the enlightened and moral railroad officers get and keep the predominant influence in guiding the policy of the railroads of the nation? They have the laws on their side, and public opinion and good morals and sound policy; but how can they prevail in the councils? Only one way that has ever been tried has seemed to promise success; that is, to allow the railroad companies to associate themselves to make and maintain rates, with power to punish each other for violations of their agreements. If they are permitted to do this the honorable railroad officers (who after all are the great majority) will not only co-operate with the Commission to stop evil practices, but will welcome the help of the Commission and the courts.

When is a Locomotive Worn Out?

Mr. Dolbeer's paper, on another page, asks the important question, "When ought a locomotive to be replaced entirely instead of being rebuilt or repaired?" The obvious answer is, that an obsolete engine, or one too light or unsuitable for present requirements, should be broken up and replaced by one of suitable type whenever opportunity offers. But this, while obviously correct, does not go quite far enough, for the difficulty arises when the engine is of suitable type, but requires such heavy repairs that it is difficult to determine which is, in the end, the most economical course to pursue.

Figures can be adduced in support of either side of the question, but they are hardly trustworthy guides, as they are based on the estimate that certain repairs will be required and will cost an estimated sum, and charged with compound interest at a rate which is also assumed. The only guide that is of any assistance in the matter is the common-sense view, that an article which is wholly and completely new is superior to one that is partly new and partly old, and the fact that this is supported by the experience of the best managed and most successfully conducted locomotive departments of many large railroads. There the tendency has undoubtedly been to renew and renew completely. To cut up boilers after a certain age and not attempt any expensive repairs, and to return the old material to the melting pot to emerge again as new mild steel sheets and bars. Similarly not to attempt very heavy repairs, but break up and renew with a completely new engine.

The philosophy of the process is obvious, and the reasons in its favor are strengthened with every increase in the weight and size of locomotives. Repairs practically mean handwork or a preponderance of handwork, while new work practically means machine work. Both hand and machine work are influenced by the surface of the material operated on. Taking two axles of similar form and the same length, one 4 in. diameter and another 8, it is obvious that the surface to be operated on is as 1:2, and consequently the cost of labor will be approximately in that proportion. But the weight of material will be in the proportion of 1:4, and consequently in the larger axle will bear a larger proportion of the total cost. Therefore, the larger the engine, the less the relative importance of the cost of labor. But in breaking up an engine, instead of repairing it, what do we throw away? The labor is wholly thrown away, and it is that that makes us hesitate to break up an engine. The material cannot be destroyed; it merely goes through the fire, and like the Phœnix of old, rises rejuvenated from its ashes. And this specially applies to the principal materials used in an American locomotive, cast iron and Siemens steel. The difference in cost between the scrap and the plates or rough castings is small, and therefore the absolute loss of material in breaking up an engine is also small. It is not therefore surprising that large locomotive shops tend to adopt the renewal as against the repair policy of dealing with worn locomotives.

The advantages of the renewal plan are manifold. 1. An entirely new engine is obtained, proportioned in every way just as latest experience has shown to be most desirable. 2. The renewed engine will probably work with fewer interruptions and make more mileage than the repaired engine, and will probably haul a heavier load and earn more. 3. The renewed engine can be manufactured systematically, one of a batch of possibly 50, and will compare with the repaired engine somewhat as machine work compares with hand work. 4. The renewed engine will, consequently, be found to better interchange its parts than the repaired engine, and will, therefore, be cheaper and easier to repair in the roundhouse.

As the renewed engine will haul a greater load and attain a greater mileage than the repaired engine, or in other words do more work, each renewed engine must be regarded as the equivalent of more than one repaired engine. If the renewed engine will run five per cent. more mileage and haul five per cent. greater load, it performs as much useful work as 1.1025 repaired engines, for:

$$\frac{105}{100} \times \frac{105}{100} = \frac{11{,}025}{10{,}000} = 1.1025$$

In other words, nine renewed engines will do as much work as 10 repaired engines. This has a very important influence on the matter of cost, and with the proportions assumed here, which are largely within the average experience, it is evident that the renewed engine would be really the cheaper even if its price was 10 per cent. higher.

As Mr. Dolbeer very truly says, it is impossible to decide the exact point at which renewal rather than heavy repair is advisable. On some roads the experience would be that when the boiler needs renewal or very heavy repairs, the rest of the engine will not last much longer. Under such conditions it would obviously be wise to make it a rule to replace the engine altogether when the boiler needed renewal. On other roads, however, with bad water, it may be common to find an engine with some years' wear in it when the second boiler is worn out. It is, therefore, obviously impossible to lay down any hard and fast rule that will apply under all circumstances, but it will very commonly be found better to renew than to rebuild or execute heavy repairs, when a full and careful estimate of the cost of the proposed repairs (including a proper allowance for establishment charges) shows them to exceed 35 to 40 per cent. of the original cost of the engine.

The "Investor's Review" on American Railroads.

It is a disquieting circumstance that the balance of trade has now turned decidedly against this country. If in spite of the enormous exports of our other products during the last year, we have also been obliged to export large quantities of gold, how, it will naturally be asked, can we retain a sufficient reserve when our exports are declining and our imports increasing? It is obvious that this can be accomplished in but one way. We cannot pay for our excess of imports in cash, and we must therefore, as a country, give our paper for our indebtedness. In other words American securities of all kinds must be accepted by European investors. For some time past, it has been satisfactorily demonstrated, these investors have been diminishing their American holdings, and it is important now to know if they are disposed to increase them.

In view of this financial situation the general status of our railroads becomes a matter of public interest,

The ten billions of securities issued by this vast industry give the principal opportunity for the investment of foreign capital. There are numerous minor enterprises, the aggregate demands of which are very considerable in amount, but they are relatively insignificant. The appearance at this juncture of a highly favorable estimate of the conditions of our railroads in the *Investor's Review*, a periodical of the highest character, and one which, in spite of its youth, has become a recognized authority, is therefore an event of no little importance. The article is very elaborate; it is the product of a writer, Mr. S. F. Van Oss, who is evidently familiar with his subject, and it is upon the whole so optimistic in tone as to indicate the probability of an improved feeling in London concerning American investments. That this feeling should exist is to be desired not more upon our own account than upon that of the British investor, for it can scarcely be denied that many sound American railroad securities have for some time been selling at prices that must be considered, in view of modern rates of interest, abnormally low.

The article to which we have referred sketches the financial history of American railroads, and makes a black picture of it. Positively, perhaps, the colors are not too dark, but the development of our railroads has only followed the lines of the general development of the country. In the desperate scramble for the subjection of an unoccupied continent to private ownership, there was what has been called a "carnival of corruption," but the part of the railroads was no worse than that of the banks and other enterprises. And with the general sobering of the community railroad management has come to be at least decent. The outrageous scandals arising from towns and counties bonding themselves in aid of railroad enterprises belong to the past, and the corruption of legislatures is at least less notorious than of old. This corruption had become so notorious as to cause an outbreak of popular indignation against all railroad corporations, and for some years they fared ill at the hands of their former tools, the legislatures. This period, too, has gone by, and at present the railroads, having secured some protection from the courts, may look for comparative immunity from legislative attack.

But the most dangerous foes of the railroads were of their own household. Their wild competition for territory and for business was often ruinous for their stockholders. The railroad managers, men of great ability in certain directions, were carried away with visions of empire, and in their jealousies and ambitions engaged in furious wars of rates, in which they lavished the money of their stockholders with a generosity which resembled that of Artemus Ward in sending all his wife's relatives to the war. Actual or impending ruin gradually caused wiser counsels to prevail, and the talents that were formerly devoted to ambitious schemes of conquest have now come to be applied to the humbler problems of economical management.

The substitution of combination for competition has been attended with great advantages, nor have the apprehensions of the public as to the dangers of monopoly been justified. In fact, so far as the public is concerned, the general result has been a magnificent success. As the writer in the *Investor's Review* puts it, the problem of reducing the cost of transportation so as to get a profit out of the low rates established by competition "has been the most difficult American railroads ever were confronted with, and it must be admitted that it has been splendidly solved. American railroads contrive to make a fair profit with rates that would be ruinous to the railroad companies of any other country. By gradually introducing an astounding technical perfection, they have saved themselves from financial ruin."

Moreover, as Mr. Van Oss observes, the relations between the railroads and the investor have undergone a salutary change. The early financial history of most companies is a record of mistakes and malpractices, but the system of American railroad finance now rests upon a sounder basis. The era of downright swindling and robbery is over. We seldom hear now of "wrecking," at least on any large scale. Frequent and trustworthy statements of traffic are now the rule instead of the exception, and the annual reports of American railroads contain more reliable and valuable information, and give a clearer view of their position and their prospects than those of Great Britain. In some particulars we should consider the views of this writer as too roseate; many practices have not lost their evil in losing their notoriety. But upon the whole the general railroad situation has greatly improved, and it is gratifying to have testimony to this effect from a competent and apparently disinterested foreign observer.

Engineer Officers in the Navy.

The case of Assistant Engineer Danforth, who was recently suspended for a year for disobedience of orders, has been generally commented on in the daily press, but further comment on it is not superfluous, as this case will probably have an important influence on the personnel of the Navy for some time to come. The facts as we learn them from an excellent authority are briefly that Mr. Danforth was on duty in the engine room, and in charge of the machinery of the ship for the time, when he received an order from the officer of the deck to report on deck. He declined to obey this order on the ground that he was stationed in the engine room by order of the Chief Engineer and the Captain, and could not leave his post unless relieved. He was then sent for by the executive officer, and responded, recognizing him as the representative of the commanding officer, but was tried by court-martial with the result mentioned above.

To a certain extent this is an outcome of the old "line and staff" difficulty in the navy, but it is of more than local interest. According to the finding of the court-martial the naval engineer of to-day is between the devil and the deep sea. He must not leave his post when on watch, as in case he did, and any accident happened to the machinery, he would certainly be held guilty of neglect of duty; and he must leave when sent for by the officer having charge of the deck or be suspended. If the deck officer took the responsibility for mishaps in the machinery department under such circumstances it would be different, but that is not to be assumed.

Suppose in the accident to the "City of Paris," the engineer on watch had been on deck, by anybody's orders, when the crash came. The result would have been the loss of the ship and passengers, and neither deck officer nor engineer would have been exonerated. There appears to be no difficulty on account of conflicting authority in the merchant marine, as each man is apparently satisfied to do the work which he is paid for, and not to assume any more responsibility than necessary. But the Navy idea seems to be that a ship's company is at all times to be regarded in the same light as an infantry company on drill, and orders must be obeyed to the letter regardless of consequences. Needless to say that this idea will not work well in practice. If an engineer is competent to take charge of the mass of machinery including from forty to sixty separate engines, which is to be found in a modern man-of-war, he must be allowed some discretion. The result which may be expected is, that which we fear some of the line officers of the Navy desire, the weakening of the engineer force by driving the strongest men out of it by petty exactions. In many cases this may be the best thing for the engineers personally, but it is certainly not for the best interest of the country that it should be so.

Cases of brutality and incompetency of deck officers have, unfortunately, been too frequently brought to the attention of the public of late. These are bad enough and make it difficult to enlist good men for the Navy, but when the safety of the new ships on which so much money has been spent, and from which so much is expected, is jeopardized by narrow ideas of military discipline, it is time some new regulations were promulgated.

Stored Energy in Car Wheels.

The stored energy in car wheels is a term which is frequently used in discussions of the resistance of cars during the period of acceleration and in analyzing results obtained from tests of air brakes. The path of each point in a car wheel is not the same as the path of each point in the car body; that is to say, while each unit of mass in a car body will, when moving, describe a practically straight line, each unit of mass in a car wheel describes a curve, which is either a true cycloid or a prolate cycloid. For this reason, between two given stations on a railroad each unit of mass in a car wheel moves through a greater distance than each unit of mass in a car body, and as the distance is performed in the same time it is evident that the unit of mass in the car wheel must have a higher velocity.

What is the same thing is this: The car wheels not only move along the track as a whole in the same way and at the same speed as the car body, but they also have a movement of rotation on their own axes. If a train be moving at 60 miles an hour, and be lifted from the track and instantly stopped, the car wheels will continue to revolve, thus showing that in addition to the stored energy due to the movement of the wheels and train along the track, there is an additional amount of stored energy due to the rotation of the wheels on their own axes, which must be added to the stored energy of the train in making calculations of the total energy.

In the past, for the purpose of comparing the results of brake tests, an approximate quantity of 6 to 10 per cent. has been added to the stored energy in the train, due to its longitudinal movement, in order to include the stored energy due to the rotation of the wheels. It is quite necessary to consider the design of the wheels and the relative weights of the wheels and the cars in each individual case, if a strictly accurate result is desired. To illustrate how the stored energies differ with the different kinds of wheels the following table is given, which contains calculations made for several different types and sizes of wheels.

Table Giving the Ratios of the Stored Energy in Each Unit of Mass of Car Wheels to that in Each Unit of Mass in Car Bodies.

Wheel — Kind.	Diameter.	Weight.	Radius of G. ration.	Ratio of units of energy.[1]	Percentage.[2]
Wrought or cast steel spoke	42	970	17.2	1 to 1.68	68
" " "	36	775	15.0	1 to 1.69	69
" " "	33	695	13.6	1 to 1.68	68
Chilled plate	39	480	11.75	1 to 1.60	60
" "	33	540	13.0	1 to 1.60	60

[1] This is the ratio of the total stored energy in each pound in the train to the stored energy in each pound in the wheels. The percentage to be added to the stored energy of the train to include that in the wheels depends upon the relative weights of the train and wheels.

[2] This is the per cent. to be added to the stored energy in the wheels due to their longitudinal movement to allow for the stored energy due to rotation.

The number of pounds in the body of the train having as much stored energy as one pound in the wheels is given in the table. This figure, of course, is independent of the weight of the train and refers only to the difference between the stored energy in one pound moving in the body of the train and one pound moving in the body of the wheel. Each pound near the rim of the wheel has more stored energy than one pound in the centre of the wheel, but the figures given are the average for the whole wheel. From this table one can determine very nearly what is the stored energy for any type of wheel that is in common use, when running at any speed, except for some of the heavy paper wheels, which are not included in this calculation. To do this it is but necessary to find the stored energy in one pound moving at the given speed and then add the percentage given in the table so as to include the additional stored energy due to rotation.

November Accidents.

Our record of train accidents in November, given in this number, includes 106 collisions, 84 derailments and 9 other accidents, a total of 199 accidents, in which 61 persons were killed and 199 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted, except where the circumstances of the accident as reported make it of special interest. These accidents are classified as follows:

Collisions:	Rear.	Butting.	Crossing and other.	Tot'l.
Trains breaking in two	7	..	..	7
Misplaced switch	7	1	1	9
Failure to give or observe signal	11	1	6	18
Mistake in giving or understanding orders	..	4	..	4
Miscellaneous	15	2	6	23
Unexplained	13	16	15	44
Total	54	24	28	106

Derailments:			
Broken rail	1	Broken coupling or draw-bar	2
Loose or spread rail	7	Misplaced switch	8
Defective bridge	1	Track repairers	1
Defective switch	2	Bad loading	1
Defective frog	2	Animals on track	2
Defective joint	1	Landslide	2
Broken wheel	4	Tunnel fell in	1
Broken axle	4	Malicious obstruction	2
Broken truck	2	Accidental obstruction	1
Fallen brakebeam	1	Wind	1
Broken car	1	Unexplained	36
Loose wheel	1		84

Other Accidents:	
Boiler explosion	3
Car heater explosion	1
Broken side rod	2
Car burned while running	1
Other causes	2
	9
Total number of accidents	199

A general classification shows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.	P.c.
Defects of road	..	14	..	14	7
Defects of equipment	7	15	6	28	14
Negligence in operating	55	10	2	67	34
Unforeseen obstructions	..	9	1	10	5
Unexplained	44	36	..	80	40
Total	106	84	9	199	100

The number of trains involved is as follows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.
Passenger	43	28	4	75
Freight and other	154	59	5	218
Total	197	87	9	293

The casualties may be divided as follows:

	Collisions.	Derailments.	Other accidents.	Total.
Killed:				
Employés	30	5	9	44
Passengers	10	1	..	11
Others	4	2	..	6
Total	44	8	9	61
Injured:				
Employés	72	26	5	103
Passengers	42	50	..	92
Others	1	3	..	4
Total	115	79	5	199

The casualties to passengers and employés, when divided according to classes of causes, appear as follows:

	Pass. killed.	Pass. injured.	Emp. killed.	Emp. injured.
Defects of road	..	11	..	5
Defects of equipment	1	14	11	9
Negligence in operating	10	42	20	73
Unforeseen obstructions and maliciousness	..	11	1	10
Unexplained	..	11	2	6
Total	11	82	44	103

Thirty-seven accidents caused the death of one or more persons each, and 53 caused injury but not death, leaving 109 (51 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with November of the previous five years shows:

	1892.	1891.	1890.	1889.	1888.	1887.
Collisions	106	112	101	75	71	73
Derailments	84	110	90	73	70	48
Other accidents	9	4	3	3	4	4
Total "	199	226	204	151	145	125
Employés killed	44	45	44	39	25	38
Others "	17	24	22	3	13	5
Employés injured	103	134	125	90	103	87
Others "	96	73	140	77	73	18
Passenger trains involved	75	71	76	59	51	36
Average per day:						
Accidents	6.63	7.53	6.80	5.03	4.83	4.17
Killed	2.03	2.30	2.20	1.40	1.27	1 43
Injured	2.03	6.90	8.83	5.56	5.97	3.50
Average per accident:						
Killed	0.365	0.305	0.323	0.278	0.262	0.344
Injured	.00)	0.916	1.293	1.106	1.233	0.480

The record for the month is not so bad as that for November of the two previous years, generally speaking; but passengers were killed at six different places, nevertheless. The most fatal accident of the month was the butting collision at Alda, Neb., where six trainmen were reported killed. The worst accident for passengers was that at Highland, Ia., on the 9th. These passengers were not in a passenger train, however. This collision seems to have been the result of most deplorable negligence. The train dispatcher took care to see that the fast freight did not leave the last preceding station until the local train actually arrived at Highland, but the aid thus given to the engineer seems only to have made him more reckless. The two men killed at Pasco Junction on the 2d were also in a freight train.

It will be noticed that there were 17 accidents in November caused by misplaced switches; nine collisions and eight derailments. Of these, two derailments and three collisions involved passenger trains, and one passenger was killed and seven injured in them. There is food for reflection in the thought that this class of accidents rarely appears in the English records. The cheapest sort of railroads there seem to be operated by men who appreciate the necessity of concentrating switches near stations and of never running trains at speed except where the switches are protected by distant signals, or at least by signals that can be seen a good distance off in clear weather. These facts emphasize the disgraceful state of things in this country, where scores, if not hundreds, of high speed trains run every day over numerous switches which the engineman does not know the position of until he gets within 500 ft. of them. And it is noticeable that in derailments by misplaced switches the excuse that "there was a dense fog at the time," poor as it is, does not appear so often as in the reports of rear collisions. A collision can always be laid to the engineman, but the risk of the unprotected switch is one that we must admit that we take with our eyes wide open.

Among the interesting "miscellaneous" collisions was one near Richmond, Ind., on the 25th, where the very simple precaution of looking for the tail lights on the train, to make sure that the whole of it had come in was neglected. In another collision the engineer, fireman and front brakeman of one of the trains were all asleep. In still another case reported in the newspapers there was no collision, but an old passenger conductor and an old engineer "had their resignations sent to them" because they forgot about an opposing train and met it between stations. Fortunately for the company and the passengers there was a long straight line just there. A narrow gauge passenger train in Colorado was overturned by the wind, every car being ditched, but it seems that the passengers all escaped with injuries which did not lay them up a great while.

At Cleveland, Nov. 12, two electric street cars were wrecked by a passenger train and six persons injured. In the same city, on the evening of the 22d, a train of an electric road was running at high speed over the long viaduct, when one of the cars jumped the track directly in the face of a train coming from the opposite direction on the adjoining track, making a very bad wreck. One passenger was fatally injured and two others badly. Four persons were killed in each of two highway crossing accidents in November. One of the cases, that at Elmira, N.Y., happened in the evening and has excited considerable comment, because the gates by which the crossing is guarded during the day are not used after 6 p. m. It appears that there is no sign to indicate that the attendant is not on duty in the evening. Such a sign should be provided, if only for its moral influence on juries. It needs to have large letters and a large lamp, and be attended to by a faithful and intelligent man.

At Marcus Hook, Pa., on the 19th, a tank car loaded with oil exploded, and the resulting fire burned several buildings and cars. On a logging road at Wadsworth, Ala., Nov. 1, a train which jumped the track knocked down a tank which fell upon a car containing 40 workmen. Fifteen of them were injured, two fatally.

An Expert Opinion on "Flexible Locomotives."

An esteemed, but English, contemporary, recently favored its readers with an expert opinion on flexible locomotives which contains so much that is new and interesting that we regret our inability to republish the article in full. The purpose of the editor is apparently to explain why American engines have proved satisfactory and have sold readily in the colonies where locomotives of English build were decidedly less successful. In the course of his remarks such frequent evidence of his well known thorough knowledge of locomotive problems is given that we feel sure all engineers will read a few extracts with interest.

"A locomotive engine and a railway constitute separate parts of a mechanical whole in just the same way that the bed of a planing machine with the V's and the framing with its grooves form part of a congruous structure. Unfortunately engineers do not always attach full value to this fact. A railway is regarded as in any case a railway, neither more nor less, and a locomotive is designed on the theory that it will have two straight, level and parallel bars of steel on which to run. Even when the truth is enforced that rails are not straight, sufficient force is not attached to the circumstance. The engine and the rails do not suit each other. . . . We think it must be admitted that locomotive builders in this country did not for many years attach sufficient importance to the advantages of flexibility in the engine regarded as a vehicle. . . . The American locomotive may be taken as an example of excellent practice in this respect; for whatever the faults of the American engine in other ways it is beyond question excellent regarded as a vehicle. Its flexibility is, however, not due to its frames. . . . The bogie originated in this country. It was abandoned, however, as unnecessary. It adds very materially to the weight and cost of a locomotive and on really good railroads there is abundant evidence that it is not needed. But on the very inferior roads of the United States it was found to be not only necessary, but indispensible. It gave not only horizontal, but vertical flexibility. It was found that very great advantage was derived from suffering a pair of wheels moderately loaded to precede the others and consolidate the road for them and even when the four wheel bogie was not used, a two wheeled 'pony' was, and is habitually used and is expressively termed a 'track-feeler.' On English roads the necessity of a 'track-feeler' has long ceased to exist and bogies in this country are used to distribute over four wheels, a weight which would be too heavy for a single axle. . . . We find too often that a bogie is indeed provided (for colonial use), but it is so rigidly fitted that it can do but one thing, radiate its axles to the curves traversed. Now the mere radiation of axles is a matter of very secondary importance on crooked and uneven roads. A bogie to be really of use under the condition prevailing abroad must possess some power of lateral movement."

After crediting Mr. Adams with having designed the first satisfactory traversing bogie in England, the editor proceeds: "This bogie virtually shortened the wheel base of 8-wheeled locomotives to any extent desired; for four wheels on two axles can get around any curve if the gauge is a little slack. It is true that the Bissel trucks had been used in the United States and in this country before Mr. Adams' bogie was invented; but there are, and always have been, objections to the Bissel truck which have ultimately led to its almost entire disuse save in a modified form for ponies, which are invariably two wheeled. In the United States, however, a rigid bogie is practically unknown. Lateral flexibility is obtained by the very simple expedient of hanging the front end of the engine by four links to the four corners of the bogie frame, which can then condition itself, to a curve without dragging the engine after it. This is the well known swing truck of which many thousands are in use in America. In this country we have always been a little afraid of this truck. Its appearance gives the idea of insecurity, and it is supposed that the engine may swing to such an extent that it will finally swing itself off the road. The fear is to this extent justifiable, that if the links are not properly proportioned and properly arranged as to angles a derailment may take place. Very much controversy has existed in the United States as to the design of these trucks. However much discussion may exist upon this and other matters, the fact remains that American engines enjoy much favor for use on bad roads because they possess flexibility and English engines do not." The editor then explains the failure of some English engines as follows: "But the first two engines were constructed under the designs of a civil engineer who knew next to nothing about locomotives. They had a long wheel base and were complete failures. Much the same thing happens in the present day on colonial roads. Designs are sent home by civil engineers, and it is found that the engines are entirely unsuited for the work. . . . We might cite one instance in which an engineer with some undue pride asserted when ordering engines that his road was as good as any in England. When he wrote this the line had not been opened. It looked very nice, and the engineer would not have hesitated to put engines carrying 14 tons on the driving axle over it. But it was to all intents and purposes a sham. The ballast and sleepers were alike bad, and before it had been a month in use it was as much as could be done to make American engines work upon it. Fortunately no orders had been placed for English engines. . . . A flexible locomotive will run perfectly on a perfect road, but a rigid engine will not work on a bad road. We feel confident that English and Scotch builders err on the safe side in a sense in making far too good an engine for colonial work, and that is one reason why America gets orders and our own firms do not. An engine driver who had been to America complained that American locomotives on which he had ridden worked like old hampers. . . . English engineers would do well to follow the American practice and build engines which will work like old hampers for new lines in new countries."

We feel compelled to call attention to some of the specially good points made by our contemporary in the above for fear that in the large mass of valuable information some of the more interesting points may be overlooked. It is obvious of course that locomotive designers have been working on an entirely wrong basis heretofore as shown by the simile in which the track is compared to the bed and the locomotive to the table of a planer. Apparently it is not enough that a locomotive should be designed on the theory that it will have "two straight, level and parallel bars of steel on which to run." It ought to be designed on the basis of the *chemin de fer glissant*. Of course a railroad should not be regarded as a "railway neither more nor less." It should be regarded in various other lights to see how it would answer for other purposes, as a planer bed, a straight edge, or a surface plate, or almost anything else. It is a great mistake to consider it simply as a railroad and expect locomotives which are designed to fit "two straight, level and parallel bars of steel," to haul trains over it.

It is evident that many engineers in this country have failed to see all the valuable features of swing trucks. Undoubtedly they do consolidate the road for the rest of the engine at times, for instance during wet weather in yards, but we admit our ignorance of the fact that they were intended for track feelers as our contemporary expresses it. Then the truism that four wheels on two axles can get around any curve if the gauge is a little slack must not be overlooked. If our contemporary had said two wheels on four axles, or three wheels on two axles, or any of the other possible combination, it would have surprised us somewhat more than this solemn statement of the number of wheels to go with a given number of axles. Of course the distance between the axles need not be considered at all. The remarks on the method of construction of swing trucks by hanging the links to the four corners of the frame will of course not be overlooked or forgotten by interested readers.

We trust that no civil engineer, no matter what his experience in other lines, will ever venture hereafter to order a locomotive, for it is evident that being a civil engineer debars him from properly understanding the requirements of the case. Or perhaps we should have said an English civil engineer, for certainly the engineers who have built American railroads are not so ignorant on locomotive topics as our contemporary seems to think English civil engineers are who go abroad.

While English builders of locomotives may feel gratified that they are building engines on the parallel-level-steel-bar basis which are too good for colonial work and that that is one reason why America gets orders, we still have a lingering idea that locomotives are built to haul trains over railroads as they are, and not to work on the the theoretically perfect roads which the despised civil engineers, above referred to, are constantly striving for and never succeed in obtaining. Until this show road exists we suppose we shall have to struggle along with our "old hampers" and leave the English builders to the enjoyment of their straight, level and parallel bars of steel, and congratulate ourselves on having received such flattering recommendations from so high an authority on railroad matters.

It is stated in a Philadelphia paper that the Pennsylvania Railroad has issued notices to be placed in prominent positions in all the stations within a radius of 25 miles of Philadelphia requesting passengers to board and alight from all trains as expeditiously as possible. The reason for this, it is said, is that it is very hard, under existing circumstances, to maintain the schedules to the exact minute. Such a notice will be a good thing if people can be made to heed it. But it is only a text, after all. The real preaching and driving must be done by the conductors and brakemen, and the main work of the superintendent will be to keep them up to the mark. On the Manhattan elevated the injunction of the trainmen to "step lively" has become a by-word and they doubtless find the duty of reiterating it thousands of times very irksome; but it is only by this constant spurring at all points that a great passenger movement can be accomplished with punctuality. General Manager Hain once told his men (in a circular issued for a "rush" day) that the country people who would then visit New York would not be used to "the energetic ways prevalent here;" and it is a fact that the thousands of habitual travelers on the elevated have learned to move promptly without being driven and (most of them) without over-riding their neighbors' rights and convenience. The same thing is true, but to a less degree, on the lines of the heavy suburban travel; but the brakeman on the ordinary railroad has a harder task, because his passengers do not have the practice of those who ride every day; but even be must remember that a half minute wasted at each one of ten stations means five minutes lost. The methods of driving passengers successfully cannot be laid down on paper very well. They must be delicate, for folks hate to be "bossed" by trainmen; but they must be constant and persistent, until people do not need to be bossed. When we speak of "driving," of course we mean driving by the inductive method, so to speak; and one of the best things a brakeman can do to induce passengers to promptly prepare to disembark without coercion is to announce the station distinctly *twice*, and always a minute or more before the train stops. We judge that there are still some 2,000 division superintendents who do not keep their men up to a proper standard in this simple matter of distinct enunciation. Surely they must have learned by this time that this widespread annoyance is not abolished simply by being shown up in the funny column of the newspapers. But, after all, the most effectual element in getting suburban trains over the road promptly, on a hard time table, is a good conductor. He needs no posted notices to passengers, nor any professor of elocution for his brakeman. His quick eye and brisk movements and pervading energy soon impel every one who often uses his train to "step lively."

A considerable number of subscribers to the *Railroad Gazette* have informed us that the paper is not usually delivered to them until Monday or Tuesday, and a knowledge of the facts is due to all of them. The regu-

lar edition is deposited in the New York post-office in installments from midnight to early Friday morning each week, and if it were handled with reasonable promptness it would be delivered at all post-offices east of the Mississippi River during Friday and Saturday. Investigations made at different times by the publishers of the *Railroad Gazette* developed the fact that two and three years ago the inefficiency of the railroad mail service was simply appalling, as was frankly admitted to us by one of the inspectors. This service has been materially improved, but at the same time the capacity of the New York post-office has become more and more unequal to the work of sorting and sending away the newspaper editions deposited for mailing. It is now not uncommon for portions of the edition of the *Railroad Gazette* to remain unsorted in the New York post-office for twenty-four hours! In a recent letter to the publisher of *The United States Mail* the Postmaster at New York admits the state of affairs recounted above, and states that it is due to "lack of room and of sufficient help at this office." He further says:

"I have done my best to secure a remedy for the main difficulty—the lack of sufficient help—by repeated representations to the Department of the constant increase in the volume of mail matter deposited here, and of the total inadequacy of the present force to handle it with any reasonable degree of promptitude, and by the most urgent appeals for the needed increase. The Department has fully appreciated the situation, but states that, in view of the exhausted state of the Congressional appropriation for clerk hire at post-offices, it is impossible to furnish any relief. . . . An incidental and most unfortunate result of the insufficiency of our force is the necessity for habitually overworking the men in order to avoid still greater delays. As a consequence their efficiency is impaired—physically by fatigue and morally by discouragement."

The statement of the Postmaster—that the inefficiency of the New York post-office is due to lack of sufficient help—is not supported by the Postmaster General, who states in his current annual report that the allowances to the New York post-office for carriers, clerks and mail messengers were for the four years ending March 3, 1889, $6,979,928.12, and for the four years ending March 3, 1893, $9,811,049.89. An increase of cost $2,834,121.77, or 40 per cent., has been accompanied by an admitted and galling deterioration in the service.

The proposed law to prohibit the use of bills of lading which contain provisions designed to relieve the carrier of certain common law liabilities, which was introduced last session by Representative Harter, of Ohio, was passed by the lower house of Congress last week. It makes it unlawful for any common carrier to insert in any bill of lading or shipping document any clause, covenant or agreement whereby it shall be relieved from liability for loss or damage arising from negligence, fault or failure in proper loading, stowage, custody, care in transport, or proper delivery of merchandise committed to its care. It appears that this proposed law is aimed principally at ocean bills of lading—those given by the railroads in the West and South for grain, cotton, etc., shipped direct to England and the continent of Europe. The demand for the law came chiefly from shippers engaged in the European trade, and the reference to domestic bills of lading was taken out of the bill by the Committee; but as it now stands it is somewhat ambiguous. The words designed to confine the application of the law to those conditions which arise only in water transportation need a comma or two to make them clear. Concerning this bill the New York *Evening Post* says:

For many years cargoes were carried from the United States to foreign countries under a form of bill of lading which exempted shipowners from liability for the perils of the sea and "the act of God." Gradually these exemptions were extended to cover all the various kinds of negligence, until at last, practically, the ship was responsible for nothing. . . . To put the conflicting claims of shipper and carrier upon an abstract equality is not easy. English laws favored the ship-owner, his rigid bills of lading being generally upheld by British courts. Many ocean bills of lading now contain a section to the effect that the contract shall be interpreted according to English rulings. The New York Supreme Court has just decided that a shipowner cannot be held responsible if valuable furs are damaged from leaky barrels of oil stowed in the same compartment of the vessel. In the House debate a recent case was cited where flour was damaged by petroleum, but without redress. It is against such exemptions as these that the House Bill is aimed. . . . The wording of the bill limits its effect by careful language to the unjust and recent additions to bills of lading. It would not revolutionize shipping customs, but would afford a reasonable protection on the part of forwarders against a combination of shipowners to escape from any and every liability connected with their business. . . . Judging by the opinion of merchants at home and abroad, the proposed bill is warranted by the situation, and in the end will work for justice to shippers and shipowners alike.

The Connecticut River road has suddenly become the most important railroad in New England, and has furnished the text for columns of newspaper writing during the past week. The directors, on Dec. 13, voted to lease the road to the New York, New Haven & Hartford, as announced in the *Railroad Gazette* last week, and the New Haven road at once took possession under a temporary agreement; but on the 16th it was announced that Boston & Maine interests had secured control of a majority of the Connecticut River stock and would refuse to execute the lease. One of the directors who at the meeting promised to use his influence to induce stockholders to vote for the lease was found to have sold out his stock for over $300 a share, and his brother directors, as well as the New Haven people, accuse him of treachery. It is denied by some that the Boston & Maine has secured an absolute majority, but the denial is not very strong. A meeting of stockholders will be held to-day which will probably settle the question. Some of the Connecticut River stock, whose par value is $100, and which has been selling at $235, was sold for $312. The total share capital of the road is (at par) $2,586,000. It is said that no railroad stock was ever before sold in Boston for more than about 280 per cent. of its par value. The chief influence of these dramatic moves on local interests hinges on the entrance of the Boston & Maine to Springfield, making a competing route between that city and Boston. The control by this company will also afford competition at Holyoke and Northampton, which the New Haven road would have effectually shut out. The gossip about the completion of a *direct* Boston & Maine route from Springfield to Boston, by the construction of a 16 mile branch from Bondville southwest to Springfield, seems to be still without foundation, however; and the report that the long talked of extension of the Reading from Tariffville northeast to Springfield would be built seems equally idle. The people who control the Reading-Boston & Maine combination will probably find what they will regard as better uses for their money than to build these pieces of almost useless railroad.

The Pennsylvania Railroad has made a radical change in the time of two or three important trains. The Pennsylvania limited, leaving New York at 10 a. m. has been set two hours later, and the St. Louis and Cincinnati express, leaving at 2 o'clock, has been set two hours earlier, both of these trains now leaving at noon. The Columbian express, which has heretofore started at 2 o'clock, along with the St. Louis train, now starts at 9 in the morning, reaching Chicago at 10 o'clock the next morning. The old morning train, No. 1, now has no through cars from New York, and is practically made up in Philadelphia, running through on the old time, which is 7½ hours slower than that of the Columbian express, which now starts just ahead of it. It is announced in the Philadelphia papers that this change is made for the purpose of facilitating the movement of freight trains. This must be only a part of the reason, however, as practically the only important improvement in that respect is the abolition of the 2 o'clock schedule. This does not help the freight trains on the eastern part of the road, however, as there are many other passenger trains besides those which run through to the West. On the Pittsburgh Division, however, the new schedule arranges all the westbound passenger trains so that the road is clear of them (at Altoona) from about 8:20 p. m. to 2:20 a. m., whereas, before, the trains leaving New York at 2 o'clock, left Altoona at 10:40. It is expected that the change in the Pennsylvania limited will be liked by business men, who can now do a little business in New York in the morning before starting on a trip to Chicago.

An important improvement has been made at the Union station in the manner of calling trains. Under the old system the cry was something like this: "Accommodation for Wall is now ready; All aboard." The train criers have now been instructed to simply announce the names of the trains in this way: "Train for Wall," "Train for Mansfield," "Train for Beaver," etc. They have also been instructed to make the statement in a clear, distinct manner, singing it having been forbidden. Travelers should now have no difficulty in hearing the call.—*Pittsburgh paper.*

The man who can subdue the train crier is greater than he that taketh a city, and we therefore agree with the Pittsburgh reporter in classing this news as "important." It is an undoubted fact that trains have been announced in that station for hours at a time without a single intelligible word reaching the ears of those passengers who were unfamiliar with Pittsburgh and vicinity. That crier has wasted more energy than all the dogs that have barked at the moon since the time of Shakespeare, for the only possible good that his noise has done has been to intimate to the passengers that *something* was probably about to happen. Pounding on a tin pan would accomplish that much. There are many other careless criers, whom we do not dare to attack openly, but whom we hope these lines will reach; the Pittsburgh man is the leader, however. We shall forgive him on receipt of sworn evidence that the above-mentioned order produces the desired effect. Meanwhile we commend to other station masters the brevity here prescribed. A short announcement serves to call the attention of the passengers, and those few who do not recognize their train by the title given to it can inquire of the crier. The task of making stationmen speak distinctly is in most cases directly proportionate to the number of words they are required to utter.

The strike of telegraph operators on the Central of Georgia seems to have practically failed, but the road and its patrons were considerably inconvenienced, as many of the operators at small stations, who acted as station agents also, deserted their posts, locking up the offices. This road is in the hands of a receiver, and two of the strikers were arrested and taken before the United States Circuit Court, charged with contempt. It seems that freight trains were considerably interrupted on various parts of the line, both on account of the lack of station agents to attend to the freight, and of operators to handle telegraphic orders for the movement of trains. It is hard to gather the real facts about any of the telegraph operators' strikes because these men seem to be peculiarly liable to the weakness of making extravagant claims concerning their alleged success. The committee which ordered the strike on the Rock Island was still in Chicago at last accounts claiming that the strike was still alive, but we hear of no difficulty in the operation of the road. It appears that there were from 75 to 100 strikers on that road, however. The operators on the Ohio & Mississippi have asked for an increase of wages and the recognition of their Brotherhood.

The railroads of Victoria appear to be in a bad way and the depression in this colony due to the collapse of the land boom, the fall in the price of silver and a prodigal expenditure of borrowed money on unprofitable railroad extensions is shown in the annual report of the railroads just issued. The total expenditure on railroads for a population of 1,100,000 was $185,000,000 all borrowed in Great Britain.

Gross revenue, year ending June 30, 1892	$15,475,000
Working expenses	10,690,000
Balance	4,785,000
Interest charges	6,935,000
Deficiency	2,150,000
Freight tonnage, gross tons	3,655,000
Passenger journeys, "	63,547,000

The freight tonnage shows a falling off of 17.3 per cent., the number of passengers a decrease of 3.3 per cent, and the gross revenue a decrease of 6.6 per cent. as compared with the previous year. The train mileage has been slightly reduced; freight rates already averaging about five times as high as in the United States have been raised and various measures of economy resorted to in the hope of stemming the tide of deficit caused by overbuilding expensive railroads into districts which have little or no population but are owned by men who control a few votes and desire to sell corner lots.

A radical railroad law has been passed by the South Carolina Legislature, and the Governor has signed it. We have not yet seen a copy of it, but it is described as giving absolute control of the railroads "without appeal" to the Railroad Commissioners. Some railroad men called on Governor Tillman, hoping to induce him to withhold his approval of the bill, but he told them that the opposition of 8,000 or 10,000 railroad employés was nothing when compared with the interests of the 50,000 or 60,000 farmers demanding the passage of the bill. The Governor was incensed, because, as he said, "Two years ago I had a bill before the legislature, and they [the railroads] bamboozled the legislature and would not allow the bill to pass. As I stated to 'Bunch' McBee [an officer of the Richmond & Danville], they have backed this water upon themselves, and now they have only to sink or swim."

NEW PUBLICATIONS.

Rules and Regulations Governing Freight Traffic. By Alfred L. Fraser, Yonkers, N. Y. Price $2.

This is a book of 210 pages, containing rules for the guidance of local freight agents in all the details of their work and of freight train conductors in that part of their work in which the General Freight Agent is interested. The arrangement is by short, numbered paragraphs, after the manner customary in tariffs. One of the well-known works of Mr. Kirkman is devoted chiefly to this subject, but aside from that we do not remember seeing an American work like this before, or at least none so full or complete. Mr. Fraser is connected with the New York Central. He is apparently well qualified for the task, and we should judge that it has been thoroughly done. His language is almost uniformly good, and the information, so far as we have noticed, is up to date in all respects. His way of stating things shows that he has either had a good deal of experience or is exceptionally bright in the art of selecting only the valuable portions of other people's experience, or both. The regulations are, however, too strict, embracing many rules which an agent cannot possibly carry out. In this, however, this book is not alone, and the author simply follows the pattern set by the usual railroad manual, in which the agent is required to treat every shipper and consignee as a thief, if not a highwayman, at every step. This line of instruction has its legitimate place of course; but in view of the fact that the traffic department is constantly instructing agents to "hustle" for business without much regard to red tape, railroad managers may reasonably ask themselves if the legal department does not exercise too much influence in the preparation of rules and regulations.

While this book will take high rank among works of this character, we are not able to see where a large field can be found for it. The attempt to make such a manual adaptable to all roads can never be successful, for the author is obliged to frequently make a foot note saying that the regulations of the reader's particular company may require him to disregard the advice given in the book. At the same time it hardly seems worth while to make a book which can circulate on only a few roads. The most obvious practical use for a book of this kind is an essay or study for freight agents to read as a sort of side light on the regulations of their own company. Mr. Fraser has one of the main qualifications for fulfilling this function satisfactorily, an easy and pleasing

style. But it is a good deal easier to correct a lot of rules and print them, than to state in clear language just why the changes introduced are believed to be improvements, especially where such a dissertation would fill two or three volumes if not thoroughly boiled down by a master hand. Perhaps it is not possible to make a manual which would "take" among station agents without following the style of the regulation book of rules; but this only serves to emphasize the need of a manual of this kind, brief, clear and simple, by which a local freight agent can more easily study the *principles* of his business.

Original Papers on Dynamo Machinery and Allied Subjects, by John Hopkinson, M. A., D Sc., F. R S. Published by the W. J. Johnston Co., Limited, New York. 369 pages. 96 illustrations. Price, $1.00.

This little work, which is written in simple language and contains few mathematical formulæ, includes all that Dr. Hopkinson has written in electro-technical science, and the distinguished name of the author is sufficient to show that the information conveyed is of very considerable importance, both theoretically and practically.

The first chapter deals with the characteristic curves of dynamos, and the succeeding three chapters further develop the subject. The fourth and fifth give the fundamental principles upon which the design of continuous current dynamos is based. The important principles, as regards coupling alternate current machines, are dealt with in the sixth chapter, and then follow three papers on the transformer and two on the theory of the alternate current dynamo and electric light houses, respectively.

The book is got up in a handy form, and the illustrations are clear, though the map showing the Macquarie or South Head, light, is very incorrect in nearly every respect, the light being shown as visible for a distance of about 70 miles, where it is below the horizon at less than half that distance, though its reflection on the clouds is said to have been observed over 100 miles off at sea.

Rates of Pay in Train and Yard Service. Compiled by the Brotherhood of Railroad Trainmen, W. A. Sheahan, Secretary, Galesburg, Ill.

This is a book of 200 pages filled with the contracts or agreements between the conductors' and brakemen's brotherhoods and numerous railroad companies in various parts of the country, to which has been added some information about the pay of men in this department of the service on various other roads. A similar work has been issued before, and the present volume is evidently a revision. The title says that the book contains the rates of pay, as well as the regulations concerning hours, etc., on the "principal" railroads of the United States, Canada and Mexico; but the index, although it fills two pages, does not show the New York Central, the Pennsylvania, the Grand Trunk or the Mexican Central. Perhaps, in the eyes of the Brotherhood, these are not principal roads. A limited number of copies of this book can be supplied by Mr. Sheahan at $2 each.

Smoke in Chicago.

At an informal dinner which took place at the Union League Club, in Chicago, last week, Mr. E. J. Phelps, Secretary of the Society for the Prevention of Smoke, made a report of the work done since the organization of the society, from which we make some extracts. Work was actually begun April 1, 1892. Up to Aug. 1 the expense had averaged a little over $1,000 a month. Since that date the society has retained its own attorneys, instead of relying entirely upon those of the city, and expenses have averaged $1,400 a month. The society has thus spent over $11,000, and on this basis, $17,000 is a conservative estimate of future annual expenses. The society began work on the theory that there were a great many people making smoke who would be willing to stop if they knew how. But it has been clearly shown that the majority of persons whose plants created dense smoke will reduce this smoke only when compelled to do so. During the first four months of its existence the society tried educational methods alone, but always with the intention of resorting to legal remedies whenever necessary. Its operations have been confined practically to the so-called business centre of Chicago, and little work has been done outside of this district.

About 600 plants in the business centre were visited during the four months, and careful investigations were made as to the conditions under which they were working. A detailed report was then sent to the person controlling each plant, stating what in the judgment of the society would most cheaply and effectively cure the smoke. It was found that reports of this character received very little attention and the society determined, therefore, to adopt an active policy of compulsion, coupled with advice when requested. Between July 1 and Nov. 1 about 325 suits have been brought by the city, at the instance of the society, against offenders under the city smoke ordinances. Of these suits 173 were for stationary plants, 82 were locomotives and 64 tugs. Of the suits against stationary plants, fines were assessed in 51 cases, 110 suits were dismissed upon payment of costs by defendants, 2 suits were lost and 16 remain untried. Of the 110 suits which have been dismissed, the defendant has either cured his smoke nuisance, or has shown a contract having a time limit for the equipment of his plant with some device approved by the society's engineer. Of the 82 suits against locomotives, the defendant has been fined in 52 cases, 21 cases have been dismissed and 9 remain untried. Of the 64 suits against tugs, a fine has been imposed in 52 cases, and 12 suits have been dismissed.

The result of the work on stationary boilers is as follows: Of the 600 plants to the owners of which expert advice was given, about one third have been cured. Of those prosecuted, about three-fourths have been cured, so that in all, from 300 to 325 nuisances have been abated. In from 100 to 150 other cases, the smoke has been lessened about two-thirds. About 10 per cent. of the steam users who have been sued have not materially reduced their smoke nuisance and continued prosecution seems to be the only method by which to approach this class.

With regard to the railroads, tests were made last spring of devices for the prevention of smoke from locomotives. May 1 a letter was sent to all the railroads recommending to them certain devices, and giving them four months in which to equip all their engines. Sept. 1 investigation developed the fact that as a general thing the railroads were taking up in earnest the subject of smoke prevention. Recourse was had, however, to legal action against some of the roads, and while it is impossible to tell precisely the extent to which the smoke nuisance as caused by locomotives has been reduced, the society's engineers have been at work for the last fortnight watching the various locomotives closely in order to get as precise information as possible. They have kept an account of the total number of locomotives observed and of those which were seen smoking. Compared with the figures taken in the same way last March a reduction since then of 75 per cent. of the smoke caused by locomotives is, apparently, a conservative estimate. This, however, applies only to such locomotives as come within two miles of the Court House. In the case of tugs, 90 per cent. of the nuisance has been removed. The tugs constituting the remaining 10 per cent. belong to individual owners and seldom come into the Chicago River.

To sum up, between 300 and 325 smoke nuisances in connection with stationary boilers have been removed, the locomotive smoke nuisance within two miles of the business centre has been reduced 75 per cent., and the tug nuisance has been reduced between 90 and 95 per cent., with a total expenditure of a little over $11,000.

Results of the Use of the Heindl Steel Crosstie.

The reports on the use of metallic ties that we get from Europe will have an ever increasing value as the element of time becomes more prominent. Unfortunately, they still show widely different results. The recently published report of M. Jansen upon his experiments with the Post & Braet tie, on the Belgian State Railroads, was far from satisfactory for these types.

Still later, however, we have heard from Herr Ast, Superintendent of Road and Structures of the Kaiser Ferdinand Nordbahn, one of the Austrian State Railroads, on his experience with the Heindl tie, which has been very gratifying. Other excellent results obtained on the Bavarian State Railroads have resulted in that to-day 30 miles of their principal lines are now laid with it, and it will be substituted at future renewals.

The Austrian observations have extended over a period of nearly nine years, beginning in August, 1883, under the following conditions: A piece of track on the line between Vienna and Cracow, two kilometers in length, on a grade nearly level, partly on a tangent and partly on a curve of 4,360 ft. radius, was laid with the Heindl system. The ties were spaced, except at joints which were suspended, nearly 3 ft. apart. Each tie was 7 ft. 10.5 in. long, and weighed nearly 160 lbs. The specifications called for soft Bessemer steel, test pieces of which, when hammered and heated to redness, should take no temper on cooling.

Seventy-lb. steel rails were used. The ballast was partly of screened gravel and partly of moderately hard broken limestone. For purposes of comparison another portion of track was laid with Burnettized oak ties of same length and spacings. Both were subjected to almost precisely the same action and traffic.

In the nine years over 80,000 trains with a tonnage of more than 40 millions of tons passed over that portion of the road. Both lines were carefully watched and inspected, and the cost of maintenance noted. The following table gives the results. Cost includes labor and material, including additional ballast:

Year.	Cost of maintenance per mile. Metallic ties.	Wooden ties.
1884	$215.26	$178.52
1885	218.06	228.80
1886	170.73	181.89
1887	107.72	139.81
1888	149.41	170.40
1889	141.95	139.65
1890	92.35	149.60
1891	65.02	177.98
Total	$1,160 49	$1,326.05
Average	$145.06	165.83

All of which shows an economy in cost of maintenance of 13.8 per cent. in favor of the all metallic way. The great increase in the cost for 1891 on the track with wooden ties, is due to the fact that the necessity for renewal began to impose itself. It is evident that this renewal will in future constantly increase the cost of maintenance.

From Herr Ast's statements we can only infer that the steel ties were in the same condition at the end of the time as when first laid. The mode of attaching the rail to the tie, he says, is excellent. During the entire time of the trial no loosening or motion has been discovered. After nine years no wear is noticeable either upon the ties or the supporting plates. The rails show no wear beyond that naturally due to the loads passed over them. In all this time not a single rail has been broken. No spreading of the gauge has been observed, although daily traversed by many trains some of which attain a speed of 50 miles an hour. No renewing has ever been done, and it is impossible to foresee the day when it will be necessary, as the official inspections still fail to discover either rust, decay or deformation. The bolt holes have perfectly retained their shape and dimensions The bolts show no wear, 231 (3.2 per cent.) have been replaced, but this was entirely due to poor workmanship.

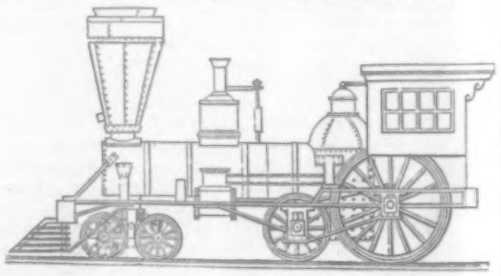
Herr Ast is of the opinion that the bad reports from the Post and Braet ties in Belgium are not due to any defect in design or proportioning. The whole matter, he argues, lies solely in the manner of fastening the rail upon the tie.

The Heindl system is complicated. For a 20-ft. rail the following is required: eight ties, four fish-plates, eight bolts for plates, 16 chairs, 32 wedges, 32 fastening bolts, 16 knee braces. The first cost per tie, with accessories is $3.82.

Some Early High Speed Locomotives.

Now that American locomotive builders are turning out engines with 6½-ft. and 7-ft. drivers, it may be a matter of interest to see what was done by Mr. Mathias W. Baldwin, as far back as the forties. The cut of the "Governor Paine" which is shown herewith and the following notes are taken from a Baldwin catalogue.

Early in 1848 the Vermont Central Railroad was approaching completion, and Governor Paine, the President of the company, conceived the idea that the passenger service on the road required locomotives capable of running at very high velocities. Mr. Baldwin at once undertook to construct for that company a locomotive which could run with a passenger train at a speed



The Governor Paine—Built in 1848.

of 60 miles an hour. The work was begun early in 1848, and in March of that year Mr. Baldwin filed a caveat for his design. The engine was completed in 1849, and was named the "Governor Paine." It had one pair of driving-wheels, 6½ ft. in diameter, placed back of the fire-box. Another pair of wheels, but smaller and unconnected, was placed directly in front of the fire-box, and a four-wheeled truck carried the front of the engine. The cylinders were 17¼ in. diameter and 20 in. stroke, and were placed horizontally between the frames and the boiler, at about the middle of the waist. The connecting-rods took hold of "half-cranks" inside of the driving-wheels. The object of placing the cylinders at the middle of the boiler was to lessen or obviate the lateral motion of the engine, produced when the cylinders were attached to the smoke-arch. The bearings on the two rear axles were so contrived that, by means of a lever, a part of the weight of the engine usually carried on the wheels in front of the fire-box could be transferred to the driving-axle.

The "Governor Paine" was used for several years on the Vermont Central Railroad, and then rebuilt into a four-coupled machine. During its career, it was stated by the officers of the road that it could be started from a state of rest and run a mile in 43 seconds.

Three engines on the same plan, but with cylinders 14 × 20, and 6-ft. driving wheels, the "Mifflin," "Blair" and "Indiana," were also built for the Pennsylvania Railroad Company in 1849. They weighed each about 47,000 lbs., distributed as follows; 18,000 on driving wheels, 14,000 on the pair of wheels in front of the fire-box and 15,000 on the truck. By applying the lever the weight on the driving wheels could be increased to about 24,000 lbs., the weight on the wheels in front of the fire-box being correspondingly reduced. A speed of four miles in three minutes is recorded for them, and upon one occasion President Taylor was taken in a special train over the road by one of these machines at a speed of 60 miles an hour. One other engine of this pattern, the "Susquehanna," was built for the Hudson River Railroad Company in 1850. Its cylinders were 15 in. diameter by 20 in. stroke, and the driving wheels 6 ft. in diameter. All these engines, however, were short-lived, and died young of insufficient adhesion.

The Florence & Fiesole Electric Railroad.

This railroad which has been recently built is the first application in Europe of electricity to a line having steep grades. It connects the city of Florence and its suburb Fiesole, the latter being about 770 ft. above the former. The length of the line is about 4¼ miles and maximum grade is eight per cent. In considering the establishment of this road it was deemed inadvisable to use steam locomotives or a cable for various reasons, and it was finally equipped as an overhead trolley road on the Sprague system. About 52 per cent. of the total length of the line is curved, the shortest curve, having a radius of 58 ft., being found on the section of steep grades. The road comprises a level section 1.5 miles long, a section having five per cent. grades 1.4 miles long, and a section having eight per cent. grades 1.6 miles long.

The central station contains three 80-H. P. return tubular boilers, three compound engines of 80 H. P. each and three dynamos of the Edison type of 55,000 watts capacity. The coal consumption is about 1,980 lbs. of Cardiff coal a day for each engine. The trolley wire is of silicon bronze and is divided into sections of about 130 ft. long. The cars have a seat in capacity for 24 people and are fitted with two double-reduction Sprague motors. The number of passengers carried is 600 a day ordinarily and exceeds 2,500 on special occasions. The cost of transportation is 3.2 cents a mile. The cost of construction and operation is given as follows:

Cost of Construction and Equipment.

Permanent way, buildings, etc.	$63,000
Three boilers and engines	19,400
Electrical equipment, complete	43,600
Twelve cars	4,850
Telephone and miscellaneous	4,850
	$135,700

Or approximately $30,000 a mile.

Operating Expenses.

	Cost for one day.	Cost a car mile, cents.
Traffic:		
Eleven conductors at 50 cents and three supervisors at 70 cents	$7.60	2.02
Maintenance:		
One superintendent at $1.60, one foreman at 60 cents and eight men at 40 cents	5.40	1.44
Motive Power:		
One engineer at $1.20, one fireman at 80 cents, two agents (!) at 50 cents, 10 motormen at 70 cents; coal, one ton, at $8; oil, water, etc., $4	22 60	5 86
Interest and Depreciation:		
Boilers, seven per cent.; electrical machinery, eight per cent.; cars, five per cent.; track, one per cent.	16.00	4.32
General Expenses:		
Office, etc.	8.00	2.21
Total		15.85

We add to this a table given in *Les Annales des Travaux Publics* of the several electric railroads in

Place.	Date when opened.	Length in miles.	Gauge of track, ft.	Maximum grade per cent.	Radius of minimum curve ft.	Total h. p.	Cost of one mile of road.	Miles run a day.	Cost of operation per train-mile—cents.
Berlin	1881	1.55	3.28	1.00	98.	..	.....	....	23.3 Double track.
"	1888	.87	"	"	"	....	.....	....	
Vienna	1883-5	2.73	"	1.6	"	185	$12,450	133.	14.6
Frankfort	1884	4.16	"	3 0	"	220	45,770	872.	18.1 Double track.
Vevey—Montreux	1889	6.46	4.76	4.5	171.	240	20,240	631.	12.5
Buda-Pesth	1890	5.65	"	1.6	82	500	.....	676.	....
Florence—Fiesole	1890	4.54	"	8.0	59.	240	29,900	374.	15.4

Europe. In the first Berlin road the circuit is formed by the rails. On the four following roads an overhead conductor placed on one side of the track is used. The Buda-Pesth lines are built with an underground conduit. It is noted that the new electric lines for Buda-Pesth are constructed on the trolley system. On the Montreux line turbine wheels are in use.

TECHNICAL.

Manufacturing and Business.

The Deitz Passenger Draw-Bar Co. filed articles of incorporation in Denver last week. Directors: Edward A. Rezer, T. C. Brainard, Henry Deitz, F. A. Wadleigh and A. R. Adams.

Frederick H. Lewis, Manager at Philadelphia of the Pittsburgh Testing Laboratory, has resigned, and on Jan. 1 will take an interest with Booth, Garrett & Blair, of 406 Locust street, Philadelphia, in a department of mechanical testing and inspection which will be organized by the firm on that date.

The Consolidated Car Heating Co. received an order on Dec. 15 for the equipment of the 100 passenger cars, probably the largest order for car heating material ever given at one time. The cars are being built for the New York Central & Hudson River Road by the Gilbert Car Manufacturing Co., of Troy, N. Y.

The North American Railway Supply Co. has been chartered at Chicago by B. E. Cummins, Benjamin F. Ray and John J. McClellan.

New Stations and Shops.

The roundhouse and machine shops of the Denver & Rio Grande, at Salida, Col., which were destroyed by fire Dec. 11, will be rebuilt at once. Eight standard gauge and nine narrow gauge locomotives were ruined. The loss is about $150,000, partly insured.

Nearly $40,000 has been subscribed for the removal of the Harris car works from St. John, N. B., to Amherst, Nova Scotia.

The firm of Jas. W. Queen & Co., of Philadelphia, has been reorganized as a corporation under the name of Queen & Co., Incorporated, with a paid up capital of $600,000. The incorporators, who are also the directors, are S. L. Fox, E. B. Fox, J. G. Gray, Wm. Biddle, Jr., J. G. Biddle and F. W. Stanwood. The manufacturing interests of this concern have largely increased in the last year or two, and it is now manufacturing extensively all kinds of electrical, engineering, meteorological and scientific instruments, steam and vacuum gauges, optical instruments, etc.

The Standard car thermometer, manufactured by the Standard Thermometer Co., of Peabody, Mass., has been adopted by the Boston & Maine, and will be used in all passenger cars.

Corinth Canal.

It is expected that the works on the Corinth Canal will be completed next spring, and the canal opened to traffic on the 23d of April, old style, being the name day of King George.

A Novel Description of a Modern Cruiser.

The following account of some of the characteristics of a new cruiser for the United States Navy is taken from a lecture delivered by Passed Assistant Engineer I. N. Hollis: There will be on Cruiser No. 13 about 61 separate engines, not counting cylinders, which would probably run up to 120, for main, auxiliary and pumping purposes. Her low-pressure piston, which is 92 in. in diameter, has an area of 46 sq. ft., a very comfortable 6 ft. by 8 ft. state room on board ship, and this piston has an initial load of 100 tons, equal in weight to three locomotives. The main piston speed at maximum power will be 11 miles an hour, and the maximum speed 16 miles an hour. The tip of the propeller blades will move through water at the moderate rate of 75 miles an hour. The condenser tubes, if placed end to end, would form a tube 33 miles long, and, if flattened out, would cover about two-thirds of an acre. The cooling water passed through these tubes will be equal to 36,000,000 gallons per day, enough to supply a large city with water. The main boilers, if placed end to end, would form a tunnel 156 ft. long, and large enough for a train of cars to pass through. If divided up into rooms they would supply a hotel with 16 fair-sized bedrooms. The heating surface is equal to 1½ acres. The grate surface, if arranged in one grate, would equal a small town lot of 20 ft. front and 77 ft. in depth. The boiler tubes, placed end to end, would be 13½ miles long. The blowers are capable of supplying 84,000,000 cubic feet of air an hour, which would supply a good-sized yacht with a 10-knot breeze. The coal required for a full power run across the Atlantic would supply 150 families for one year. With 20,000 H. P. she would lift herself (7,500 tons weight) to the Brooklyn Bridge in three minutes, if hoisting ropes were coiled around drums on the shafts. If the engines were set up on shore, and used as a catapult, they would throw a 300 lb. weight with such velocity that it would go off into space entirely clear of the earth's influence. The fictions of Jules Verne sink into insignificance by the side of this coal-eating monster of the nineteenth century.

The World's Fair Tower.

The foundations for this tower are now being put in near the eastern end of the Midway Plaisance, and so between Fifty-ninth and Sixtieth streets and close to the main part of the World's Fair Grounds. The tower is to be about 592 ft. high over all and 210 ft. in diameter, and is to be built mainly of steel. The contract for the steel work has been let to the Phœnix Bridge Co. Winding around the tower is a spiral having a grade of about 7% per cent. on the outside and about 11½ per cent. on the inside. Electric cars will be used for the ascent and descent, the outside track being used in going up. The trains will consist of a four wheeled motor car equipped with two 15-H. P. motors, a two-wheeled trailer which is partially suspended from the motor car, and a similar two-wheeled car attached to the front end of the motor car. The wheels on the suspended cars are loose on the axles. The capacity of each train arranged in this way will be 54 passengers. Mr. W. H. Johnstone, of Philadelphia, is President of the company. Mr. Karl L. Lehman is Engineer, and is the patentee of several features which will be used in the tower construction and in the equipment of the cars. Several details in the ornamentation and other minor features have not yet been completed, but drawings are now being made under Mr. Lehman's direction.

Nicaragua Canal.

The Nicaragua Canal bill has been reported by Senator Sherman, who gave notice in the Senate that he would call it up at an early date. The new bill is drawn on substantially the same lines as the bill reported at the last session. It includes a proposition to guarantee bonds of the company to the extent of $70,000,000. The real and personal property and franchises of the Company are included in the liabilities. In the third section it is provided that all the stock heretofore subscribed for or issued shall be called in and canceled; that all bonds issued shall be redeemed and canceled, and that all outstanding obligations shall be satisfied before the act takes effect. The dates are changed so as to make the bonds issue Jan. 1, 1893, and to make them mature in 1953, instead of 1911, as proposed in the original; and they are also made redeemable at the pleasure of the United States after 1903. The section authorizing the Secretary of the Treasury to deliver to the company bonds equal to the expenditure prior to January, 1893, is amended by requiring the company first to satisfy all liabilities and to accept the provisions of the act by resolution of stockholders, and the total amount, principal and interest, of the bonds that may be issued for the first payment is fixed at $6,000,000 instead of $4,000,000, as in the original bill. There is also included in the same section a new provision for the payment to the company of $1,000,000 interest-bearing bonds, the proceeds of which are to be used as a working capital and applied exclusively to the construction of the canal to be accounted in the settlement and deducted from total issue of bonds. Other important changes in the bill are those made in the 9th section relative to the issue of stock. In the new bill this is limited to $100,000,000; an amount left blank in the bill to be retained by the company; the amount stipulated to be delivered to the governments of Nicaragua and Costa Rica according to the concessions and the remainder to be issued to the United States, full-paid and not subject to assessment: to be voted by the President of the United States or his proxy at stockholders' meetings. Only three directors are to be selected from the holders of the stock other than that owned by the United States. In the last section an amendment is made so that ten instead of six of the fifteen directors shall be appointed by the President of the United States, not more than five of whom shall be appointed from one political party.

Lake Dredging Contracts.

Bids have been received for five out of the eight contracts for the 20 and 21-ft. channel between Duluth and Chicago and Buffalo. They are tabulated as below:

Section.	No. of bidders.	Lowest.	Highest.	Average.
Sec. 2, Little Mud Lake, sand, gravel and hard pan, 380 000 yds.	5	25.9 cts.	42 cts.	37.98 cts.
Sec. 3, Sailors' Encampment, 90 266 yds., limestone rock	6	$2.43	$5.00	$3.57½
Sec. 6, St. Clair Flats, 950,000 yds., clay and sand	13	16½ cts.	34 cts.	23¼ cts.
Sec. 7, Grosse Point, 2,900,000 yds., clay and sand	11	14¾ cts.	41 cts.	28.14 cts.
Sec. 8, Mouth of Detroit River, 1,086,000 yds., sand and gravel	9	18 cts.	74 cts.	35.54 cts.

Seventeen contractors in all put in bids, and the lowest bidders were: Section 2, C. E. Mitchell & Co., Ludington, Mich.; Section 3, John Hickler, Buffalo; Section 6 James Rooney, Toledo, O.; Section 7, Breyman Bros., Toledo: Section 8, E. P. & J. A. Smith, Cleveland, O. The bids are below the engineer's estimates, so that the appropriation, $3,334,000, will undoubtedly complete the channel to the full width desired by General Poe.

THE SCRAP HEAP.

Notes.

Senator Sawyer has introduced in Congress a bill imposing heavy penalties upon persons who "hold up" passenger trains.

The local freight agent and the cashier of the Louisville & Nashville at Cincinnati have been detected in irregularities, and, it is said that the shortage of cash is $50,000.

The engine house and shops of the Denver & Rio Grande at Salida, Col., were burned last week, the estimated loss being $125,000, which includes damage to a large number of locomotives.

The Pullman Palace Car Co. has sued for an injunction enjoining the Missouri, Kansas & Texas from making a contract with the Wagner Co. and arguments were heard at Topeka, Dec. 21, by the Supreme Court. The Pullman Co. claims that its contract made with the Missouri, Kansas & Texas before that road went into the hands of a receiver is still in force. The railroad company claims that it is not now bound by the contract, the road having been reorganized and taken out of the receiver's hands.

World's Fair Notes.

The installation of exhibits has already begun, but has not yet progressed far.

All of the World's Fair offices, with the exception of two or three, have been removed to Jackson Park. A considerable number of the offices are in the Administration Building, while others are in the respective department buildings.

The building which was authorized for the educational exhibit, and which is to be placed in the southeast corner of the Park, will be used for the ethnological exhibit, while the educational exhibit will remain in the Manufactures and Liberal Arts Building.

The plans for the power station for the Intramural Elevated Railroad have been nearly completed by the General Electric Company. The station will contain a large variety of engines, condensers, etc., as the machinery is largely intended for exhibition purposes as well as for power.

The section from one of the California redwood trees which will be exhibited in the Government Building, has arrived. It is 30 ft. long by 23 ft. in diameter, and 11 cars were used in bringing it across the continent. The section is hollowed out, and will be placed on end, divided into two stories and lighted, forming a rustic house.

The methods of manufacturing ice, and the systems of cold storage will be well represented at the World's Fair. A building having a floor space of 130 by 255 ft. and five stories high will be used. About eighty tons of ice will be manufactured daily by the three methods of the plate system from filtered water, the can system from distilled water, and the can system from de-aerated water.

The Lake Coal Trade of Buffalo.

The total shipments of coal by lake from Buffalo have been for the past three years as below, to which is added the shipments to ports taking over 10,000 tons each.

	1892.	1891.	1890.
Chicago	1,179 635	957,805	952,480
Milwaukee	715,975	608,140	451,550
Duluth	348,581	257,625	199.230
Superior	200,680	163,075	127,300
Toledo	102,525	64,620	96,230
Gladstone	52,500	35,170	30,215
Green Bay	35,300	29,015	22,380
Racine	31,029	30,510	29,130
Saginaw	26,110	23,460	21,505
Detroit	22,500	24,560	49,065
Marquette	21,189	20,935	17.775
Ashland	20,200	12,075	9,750
Bay City	15,295	13,335	8,180
Fort William	14,085	20,860	5,070
Port Arthur	3,400	3,860	2,065
Totals	2,852,330	2,365,895	2,097,770

Port Arthur is added, as shipments to this place should be counted with those to Fort William, as Duluth and Superior shipments should be counted together. Nearly all of this coal was anthracite, excepting shipments to Fort William and Port Arthur, about half of which were soft coal. In addition to the lake trade in coal Buffalo has a considerable export trade by railroad, mostly soft coal, the duties for which have not been collected in the past.

The Traffic of the St. Mary's Falls Canal.

In the following tables appears a statement of the traffic through the "Soo" Canal.

Items.	Designation.	Season 1891.	Season 1892.	Inc. or Dec. Per cent.
(a) Vessels	Number,	10,131	12,580	23
Lockages	Number	4,981	5,867	18
Tonnage, register	Net tons	8,400,685	10,647,203	27
Tonnage, freight	Net tons	8,888,759	11,214,313	26
Passengers	Number	26,190	25,896	d.1
Coal	Net tons	2,507,532	2,904,266	16
Flour	Barrels	3,780,143	5,418 135	43
Wheat	Bushels	38,816,570	40,9.1,780	6
Grain, other than wheat	Bushels	1,032,104	1,666,690	61
Manufact'd & pig iron	Net tons	69,741	101,520	46
Salt	Barrels	231,5 8	275,740	18
Copper	Net tons	69,13[illegible]	64,993	d.6
Iron Ore	Net tons	3,563,213	4,9.1,132	38
Lumber	M feet B. M.	366,3 5	512,844	40
Silver ore	Net tons	1,731	1,930	11
Building stone	Net tons	44,080	39.688	d.10
(b) Unclassified freight	Net tons	417,093	459,146	10

NOTE (a) Steamers. .....8,737 Sails .....3,324 Unregistered... 519 Total.....12,580

NOTE (b) Included in the item of unclassified freight is 490 tons of wool and 626 tons of hides.

Canal was open to navigation during the season of 1891—225 days, and during the season of 1892—233 days.

ESTIMATED VALUE OF FREIGHT—SEASON OF 1892.

Items.	Designation.	Quantity.	Price per unit.	Valuation.
Coal (hard and soft)	Net tons	2,904,266	$3.50	$10,161,931
Flour	Barrels	5,418,135	4.00	21,672,540
Wheat	Bushels	40,991,780	.75	30,746,385
Grain (other than wheat)	Bushels	1,666,690	.56	9 3 346
Manufactured iron	Net tons	59,772	50 00	2,988,600
Pig iron	Net tons	41,718	17.00	7 9.716
Salt	Barrels	275,740	1.00	275.740
Copper	Net tons	64,993	200 00	12.998,600
Iron ore	Net tons	4,904,132	3.50	17 153,962
Lumber	M ft. B M.	512,844	18 00	9 231,19:
Silver ore and bullion	Net tons	7,930	153 79	296,814
Building stone	Net tons	39,698	10.00	396,980
Unclassified freight	Net tons	459,146	60.03	27,548,760
				$135,117,267

NOTE.—The price per unit is based on the estimated value used in 1885, except in case of flour, wheat and grain, where prices of 1892 are used.

Average value per ton of freight $12.05

The value of the freight passing through the canal on the basis of the valuation established in 1885, and the registered net tonnage have been as below.

Year.	Value.	Net tonnage.
1885	$53,413,472	3,256,628
1886	69,080,072	4,527.759
1887	79,031,758	4,897,598
1888	82,196,020	5,130 659
1889	83,732,527	7,274 935
1890	102,274,949	8,454,435
1891	128,178,269	8,400,685

In 1881 when the new lock was opened the registered tonnage passing was only 1,567.741 tons. The value of the freight passing through the canal this season was greater than the value of imports into any two ports of the United States, except New York, for the fiscal year ending with June 30, 1892. General Poe's computation of the cost of the freightage passing through this canal cannot be expected for some time. Last year's season's work figured out 820.4 miles as the average distance of freight transport and an average cost of 1.35 mills per ton mile. If we apply these figures to the traffic of this season the earnings of the vessels using the canal will be nearly twelve and a half million dollars as compared with a little less than ten million last year. This would make the cost of transportation nearly 9.2 per cent. of the value of the freight. And the difference between the cost of railroad transportation for an equal distance, assuming the railroad rate at 9 mills, would be over seventy million dollars.

The Chesapeake & Ohio Steamship Line.

It is announced that all the papers for the organization of the Chesapeake & Ohio Steamship Co., Limited, have been signed and the capital all subscribed. The Chesapeake & Ohio railroad owns a majority of the stock. Contracts have been awarded to builders on the Clyde for the construction of six steamers. Three of them are about the size of the new White Star steamer "Cufic;" the other three are about one-fifth smaller. These steamers are to make regular weekly sailings from Newport News to England. Mr. Ingalls says that the export business from Newport News is now more than enough for these steamers. Last year over 120 steamers were loaded by the Chesapeake & Ohio from that port for Europe.

Railroads as Coal Miners.

The House Committee appointed to investigate the Reading Railroad anthracite coal combination resumed its inquiry at Washington, Dec. 15. William H. Joyce, General Freight Agent of the Pennsylvania Railroad, was examined, and among other things said that the policy of the Pennsylvania had always been opposed to the joining of the two occupations of producing and transporting coal, but he was afraid that the company was so deep in it now that it could not get out. But unless the Pennsylvania officers had done just what did, the road would not, in his opinion, be carrying any anthracite coal whatever, for the other roads were buying up coal lands as fast as possible.

Eckley B. Coxe, of the firm of Coxe Bros. & Co., mining more than a million and a quarter tons of coal a year, said: "I think the people who have put their money into coal mining since the war have not, on the whole, made a fair interest on their money. Until a comparatively recent time nine out of ten have failed."

The New York Hours-of-Labor Law.

The New York State Court of Appeals last week heard arguments in the case of the People against James H. Phyfe on a demurrer to an indictment found by the Grand Jury in Westchester County, charging Phyfe with a violation of chapter 711, Laws of 1892, which provides for a limit of hours' service on railroads.

The indictment alleges that Phyfe, as Superintendent of the Harlem division of the New York Central, permitted and required a trainman employed by the company at $2.10 per day, to work 14¼ hours continuously. There was no delay caused by accident, nor was there any unavoidable delay. The defendant demurred, holding that the facts stated did not constitute a crime. Counsel for the people held that the law violates no contract, takes away no property and interferes with no vested rights and is a valid exercise by the legislature of the police power. The defendant argued that the act authorizes such an interference with private business and property and the freedom of contracts as is forbidden by the State Constitution. The legislature can impose upon the railroad company such burdens as the public good requires, and, except the discharge of its obligations to the public, it is a private corporation and at liberty, within the scope of its being, to make any contracts which any individual citizen can make.

The Minority Opinion in the Lake Front Case.

The dissenting opinion of Justice Shiras in the Chicago Lake front case was laid before the Supreme Court Dec. 16. Mr. Shiras holds that the ownership of a state in the lands underlying its navigable waters is as complete and its power to make them the subject of conveyance and grant as full as its ownership and powers in the case of other public lands of the state. The act of the Illinois Legislature conveying to the Illinois Central Railroad certain rights to these submerged lands, he holds establishes a valid contract, with these restrictions only: that the company shall not have the power to sell or alienate such lands nor to maintain obstructions to Chicago harbor or to impair navigation. Should the railroad company disregard any of these restraints the state had the power, by judicial proceeding, to enjoin it or could treat it as a legal ground for forfeiting the grant. But so long as the railroad company fulfilled its part of the agreement, so long was the state of Illinois inhibited by the Constitution of the United States from passing any act impairing the obligation of its contract.

"The able and interesting statement in the opinion of the majority of the court," Justice Shiras says, "as to the rights of the public in the navigable waters, and of the limitations of the powers of the state to part with its control over them, is not dissented from. But its pertinency in the present discussion is not clearly seen. It will be time enough to make the doctrine of the inviolability of public rights when and if the railroad company shall attempt to disregard them.

"The obvious conclusion from the foregoing view of the case," he says, "is that the act of 1873 was an arbitrary act of revocation, and, not passed in the exercise of any reserved power, is void; that the decree of the court below should be reversed and that the court should be directed to enter a decree dismissing the bill of the state of Illinois and the cross bill of the city of Chicago." Justices Gray and Brown concur in this minority opinion.

The Railroad Improvements at Elizabeth.

Work on the Pennsylvania elevation at Elizabeth, N. J., has been practically at a standstill during the past week, owing to the unfavorable weather. The commencement of the street depression at Railway Avenue and some work on the foundations at the Broad street-Morris avenue crossing being the only work of construction done. At a town meeting held last Friday, it was decided to recommend to the council a plan of making a single depressed crossing at the Broad street-Morris avenue intersection, and the diversion of Morris avenue into that street north of the crossing. The City Council has adopted this plan by a vote of 14 to 6, and it has been agreed to by the railroad authorities.

Land Grant Railroads in Australia.

While it is getting to be difficult, if not impossible, for the Australians to negotiate loans in London on a satisfactory basis of interest and commissions, the demands of large areas for cheaper transportation are increasing, and our system of land grant railroads seems to be meeting with increased favor. Western Australia and Queensland have already adopted it. On the occasion of a motion in the Melbourne Legislative Assembly for the construction of lines of railroad from Bairnsdale in Gippsland to the New South Wales border, and also for connecting the irrigation settlement at Mildura with the railway system of the colony on the land grant system, Mr. Wheeler, the Minister of Railways, said that they must have recourse to private enterprise, paying those who built the roads in the State lands, if they could not obtain the money in the usual method of raising loans in London. This view seemed to meet with general favor in the house. Proposals had just been made by a French syndicate to construct reproductive works to the value of two or three million sterling, offering to accept payment in government debentures, and although they proposed to strictly confine themselves to the employment of local labor, to use French engineers in the location and construction of the work. Sir Graham Berry, the Treasurer, decided to decline the proposals of the syndicate on the ground that their acceptance would create irritation among British capitalists and brokers interested in Victorian stocks, and might seriously prejudice the colony in negotiating its future financial transactions on the London market.

Cheating the Accident Record.

The Erie limited going east on the Chicago & Grand Trunk narrowly escaped a disastrous collision with a light engine last night between Emmet and Capac. The light engine was in charge of Engineer Hutchinson, who had orders to look out for the express. Before reaching Emmet, Hutchinson's watch ran down or stopped for some reason or other. Upon reaching Emmet, Hutchinson looked at his watch, and apparently had plenty of time to reach Capac ahead of the express, and accordingly kept on. When about half way there he came face to face with the express, but luckily the engineers sighted each other on a straight track, and they had time to stop before they came together. Engineer Ryan and Fireman Kerwin, of the express, jumped after reversing the engine, and were badly cut on the face and head by cinders. It is a strange coincidence that Harry Ryan, the engineer of the express, has twice met with accidents in the same locality, and wears a gold badge, presented to him by the passengers of a train which he was running, for faithfully sticking to his post during an accident about four years ago.—*Port Huron Dispatch, Nov. 27.*

Argentine Railroads.

From a summary of the annual report of the Direction of Railways for 1891 in the *River Plate Railway News* we take the following items: In 1890 the mileage of 18 different lines was 5,710 miles, with a capital account of £38,800,000, and in 1891 there were 24 lines reporting 7,310 miles with a total capital account of £74,900,000, or nearly $59,000 a mile in 1890 as against somewhat over $51,000 in 1891. This is apparently due to the necessity for adopting a more economical style of construction than that obtaining before the failure of the Barings.

There has been a notable decline of passenger and goods traffic since 1889, notwithstanding the fact that 2,600 miles of new lines have been opened.

Years.	Passengers.	Tons goods.
1889	11,104,000	6,720,000
1890	13,067,000	5,465,000
1891	10,820,000	4,630,000

This decline is said by the *News* to be mainly due to the "bullock cart competition" in regard to which London directors have "spoken feelingly." It would seem that where any large percentage of intending passengers or shippers after fairly balancing cost, speed, luxury and certainty of arrival, elect to take a bullock cart in preference to a railroad train, some one connected with either the construction, maintenance or operation of the road so neglected should be spoken to feelingly.

The receipts and expenditures for the last three years in "shinplaster currency" have been as below:

	1889.	1890.	1881.
Receipts	$35,240,000	$11,163,000	$37,435,000
Expenditures	24,440,000	27,781,000	30,263,000
Profit	10,830,000	13,381,000	18,175,000

Working expenses averaged 70 per cent. in 1889; but declined to 68 per cent. in 1891. The total net earnings of all the Argentine roads in 1891 amounted to "only £770,000 sterling; or a fraction over one per cent. on the cost of construction." The profits for the three years mentioned have been as below, in percentages on capital:

1889.	1890.	1891.
2.4	1.6	1 3

Our English fellow railroaders are not noted either for the cheapness with which they construct railroads, low tariff charges or economy of operation, but this record is probably a little worse than usual.

The results shown, however, or some other esoteric result, seem to be satisfactory to those who are furnishing the capital, for in addition to the 1,600 miles of new railroads opened in 1891 there were 1,520 miles under construction in December last.

The Transcaspian Railroad.

The *Journal of the Ministry of Finance* in Russia has published some statistics with regard to the traffic of the Transcaspian Railroad, which was opened from the shores of the Caspian Sea to Samarcand in May, 1889, the length of the line being nearly 900 miles. Before the construction of this road the only means of communication with Kiva, Mero, Bokhara, Samarcand and Tashkent was the caravan route through Kazalinsk. Since the opening of this line the export of Russian goods has increased by more than 110 per cent.; amounting to over 11,000,000 prods for last year, and the number of passengers carried was 202,408, besides some 40,000 soldiers. During the construction of this road the Russians, after thoroughly whipping the wild tribes living in the desert northeast of of Persia, employed them, with the Persians they had been robbing, as shovelers, etc., and after its completion many of them found work on irrigating canals and as agriculturists. One result of this policy is of interest to us as it resulted in the shipment of 2,500,000 lbs. of cotton last year. The other principal exports from the country were grain, wool and rasins, with about 4,000,000 lbs. of Indian tea in transit.

As soon as Russia finds money enough to extend that road north to join the Siberian railroad, now under construction, and south to a junction with the British lines, extending from India, the cheapened transportation and better government which follows railroads will work a revolution in Central Asia, making it once more serviceable to the rest of the world as well as to its own inhabitants.

Tempered Copper.

A successful test of a small copper model gun, tempered by the secret process of F. Allard, Levis, Quebec, was carried out this month at the Citadel, Quebec, under the supervision of Lieutenant-Colonel Montizambert. Measures were taken before firing, and were found to be as follows: Length of piece, 12 in.; length of

bore, 11.50 in.; diameter of breech (outside), 1.025 in.; diameter of bore, 0.525 in. Before firing, the gun was carefully gauged at two different points, one and two inches from breech end of powder chamber. First experiment: The gun was charged with ¾ oz. of sporting powder, and wadded with a plug of paper driven well home with a mallet. After firing the charge, the gun was examined and gauged at the above-mentioned points; the diameters were unchanged. Second experiment: The next test was a very severe one, 1¾ oz. of sporting powder being used, leaving only sufficient room for a plug of paper, which, as before, was driven hard home, filling the piece to the muzzle. This charge was fired with a piece of Bickford's fuze. On examination with the instruments at Colonel Montizambert's disposal, after firing, the gun was found to be without a flaw or perceptible expansion.

West Virginia Coal Lands.

A syndicate of capitalists has bought 23,000 acres of coking coal land in the New River region of West Virginia. The price paid was $38.78 an acre, or $800,000, and it is the expressed intention to increase the coking industry along the Chesapeake & Ohio Railroad so that it shall be a rival to the Connellsville region. Drexel, Morgan & Co. purchased some time ago 40,000 acres of what is known as New River coking coal land in the Piney River region in the same neighborhood, so as to secure its traffic for the Chesapeake & Ohio. That company is building a road from Riverview or Thurmond station, 12 miles of it having been placed under contract. This branch will cut through the mountains at the mouth of Soup Creek and up Soup Creek through the 23,000-acre tract to a point from which it is contemplated ultimately to extend it to the 40,000 tract. As has been stated before, the work of connecting the Kanawha & Michigan road with the Chesapeake & Ohio by a bridge at the mouth of Gauley River and the extension of the Kanawha & Michigan to that point is well under way. This will give the new coke field the best of transportation—a direct route to Toledo—in addition to which the Chesapeake & Ohio already reaches the Northwest, and to the East and South over its own and the "Big Four" lines. The preparations for the development of the coking industry will begin at once—contracts having already been made. The New River coking coal has been fully tested by practical use for many years past and has been found to produce a first-class article. It is purer and higher in heat producing elements than the Connellsville product and has almost, if not quite, as substantial a structure. It has been used most satisfactorily in heavy furnaces in Ohio and produces a No. 1 iron. Heretofore it has never been backed by strong capital that could push it to new and remote markets.

LOCOMOTIVE BUILDING.

The Philadelphia & Reading proposes to build 25 new engines, in addition to the locomotives now being built at the Baldwin Locomotive Works, where the new engines will also probably be built. The classes have not been determined upon, but 15 will be passenger engines with Wootten fireboxes, and the balance freight engines.

CAR BUILDING.

The Atchison, Topeka & Santa Fe has ordered 700 cars from the Michigan Peninsular Car Co.

The Pittsburgh, Shenango & Lake Erie has issued specifications for 1,500 gondola cars for its ore and coal traffic.

The Illinois Central has divided the contracts for 1,500 cars between the Mount Vernon Car Co. and the Missouri Car and Foundry Co.

The Philadelphia & Reading has, it is reported, ordered 50 passenger cars, including smoking and combination cars, built at its own shops during next year.

The Cumberland Valley road is building 12 stock cars equipped with Janney couplers and airbrakes at its shops at Chambersburg, Pa. It is said that the shops have an order for four passenger cars. They are now employing about 140 men.

BRIDGE BUILDING.

Charlottetown, P. E. I.—J. W. Morison, Secretary of Public Works, will receive tenders until Jan. 4 for building a new bridge in Queen's County, plans to be seen at the office of Chas. Taper & Co., Bradalbane, P. E. I., or at the office of the Secretary.

Covington, Ky.—The new cantilever bridge over the Licking River between Covington and Newport, which was built by the King Bridge Co., was opened for travel on Dec. 18. It is 1,000 ft. long, with a main span of 360 ft., and is 65 ft. above low water mark.

Detroit, Mich.—The King Bridge Co., of Cleveland, was the lowest bidder at $3,975 for constructing an iron bridge over the loop canal on the south side of Belle Isle.

Havana, Ill.—The King Bridge Co., of Cleveland, O. has secured the contract from the Jacksonville & Southeastern Line for a bridge across the Illinois River at Havana, Ill. It will consist of 360 ft. draw span and 250 ft. fixed span. E. L. Corthell, C. E., is Engineer in Charge.

Hendricks, W. Va.—The new steel bridge over Little Black Fork River, at Hendricks, W. Va., will probably be completed by Jan. 15. The Pittsburgh Bridge Co., of Pittsburgh, Pa., has the contract for the superstructure and erection, and has the material on the ground. The stone work is completed.

Jacksonville, Fla.—Four large steel bridges will be built on the Savannah extension of the Florida Central & Peninsular Railroad which is now under contract. The bridges are across the St. Mary's, Altamaha, Satilla and Ogeechee rivers. The length of these bridges are as follows: One of 420 ft. with three spans, the draw span being 144 ft.; one of 410 ft. with three spans, draw span 134 ft.; one of 686 ft. with 5 spans, draw span 134 ft.; one of 342 ft. with two spans, draw span 114 ft.

Kanawha County, W. Va.—The County Court of Kanawha County, W. Va., has appointed C. C. Lewis and J. Schwabe a special commission to secure the necessary legislation, if such be required, to permit the county of Kanawha to build a nighway bridge from Charleston, the county town and state capital, across the Great Kanawha River. The state legislature meets in January and if the needed legislation can be secured, work will begin early in the spring.

Montreal.—Mr. Haggart, Minister of Railways and Canals, has let the contract for the Wellington street bridge over the Lachine Canal to the Dominion Bridge Co., of Montreal. The bid is said to be about $35,000.

Oliver's Ferry, Ont.—The tender of James Summers has been accepted for the construction of the public swing bridge at Oliver's Ferry, Ont. The bridge will have oak piers and iron superstructure.

Pittsburgh, Pa.—The sub-committee of the City Council appointed to examine the various sites for a free bridge over the Monongahela River, has decided upon South Twenty-second street as the location. There is considerable opposition to this site.

Waco, Tex.—The Board of Trade has proposed a plan to have the Citizens' Electric Railroad Co. build a bridge across the Brazos River with room for street car track, wagon road and sidewalks, the city and county to bear half the expense.

Washington, D. C.—The House of Representatives has passed bills authorizing the construction of bridges across the Mobile River, Alabama; over the Tennessee River at Deposit, Ala.; also across the Tallapoosa and Coosa rivers in Alabama.

Welch, W. Va.—The County Court of McDowell County, W. Va., has engaged an engineer to prepare plans and specifications for a highway bridge over Elkhorn River at Welch, in that county.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

The Supreme Court of Missouri holds that the statute which requires railroads to furnish double-decked cars for carrying sheep when requested, under a penalty, is constitutional, being a proper regulation.[1]

The Superior Court of the United States decides that under the Kentucky statute authorizing the leasing of one railroad to another when, together, they form a "continuous line," it is not essential to the validity of a lease that the leased road shall be an extension from either terminus of the main line, but it may be merely a collateral branch, forming a continuous road, via the junction, to either terminus of such main line, in as direct a route as the average railroad.[2]

A Pennsylvania statute declares that railroads "shall have the right to construct roads so as to cross at grade the track or tracks of any other railroads," etc. Another statute provides that it is the duty of courts of equity "to ascertain, and define by their decree, the mode of crossing of railroads which will inflict the least practical injury on the rights of the company owning the road which is intended to be crossed; and, if, in the judgment of such court, it is reasonably practical to avoid a grade crossing, they shall by their process prevent a crossing at grade." The Supreme Court rules that, where plaintiff company's railroad is so constructed as to cross defendant's railroad twice within four miles, and it would be practical to so locate its route as not to cross it at all, plaintiff will be restrained from crossing defendant's road at grade.[3]

The Federal Court holds that it is the usage in this country for all railroad companies receiving cars from other roads to make necessary repairs at their own expense, unless the car is inspected and branded as defective when received; and in view thereof a company which claims cars belonging to another road, and, pending a judicial determination of the title thereto, is, by agreement, permitted to retain and use them subject to a rental in case the decision is against it, cannot, after such decision, set off against the rental any claim for the cost of repairs.[4]

In Missouri the Supreme Court rules that a railroad's buildings are subject to taxation, like other property, at the local rates fixed in the districts where situate, and not at the average rate throughout the county.[5]

In Florida the Supreme Court rules that where a tariff of freight and passenger rates has been established by the railroad commissioners, and a railroad company and the commissioners differ as to whether such rates, considered as a whole, will prove remunerative to the company, and there is room for a difference of intelligent opinion on the subject, the courts cannot substitute their judgment for that of the commissioners, but the tariffs as fixed by the commission must, in so far as the courts are concerned, be left to the test of experiment.[6]

The Supreme Court of the United States holds that a lease of one railroad to another for the term of 999 years is unlawful and wholly void, and cannot be subsequently ratified, unless expressly authorized by the charters of both corporations, or by the laws of the States creating them.[7]

In the same case the same court holds that statutes which authorize any railroad company of Indiana "to intersect, join and unite" with any railroad of an adjoining state constructed to the state line, and "to make such contracts and agreements with any such road . . . for the transportation of freight and passengers, or for the use of its road, as to the board of directors may seem proper," do not authorize one railroad corporation to lease the road of another.[8]

Carriage of Goods and Injuries to Property.

In the same state the same court rules that where a carrier wrongfully refuses to accept cotton for transportation, the shipper cannot abandon it to the ravages of weather at the carrier's expense, the shipper being bound to properly protect it, and the carrier being liable for the reasonable expenses therefor, together with proximate damages for delay.[9]

In Indiana the Appellate Court decides that in an action for killing stock the road is liable, without regard to its negligence or plaintiff's contributory negligence, when the road is not fenced.[10]

Injuries to Passengers, Employes and Strangers.

In Georgia the Supreme Courts rule that when a passenger leaps from a train while it is in motion, the company is not liable for his injuries, although the train was not stopped at the station long enough to afford passengers reasonable opportunity to get off.[11]

In New York there was evidence that plaintiff was injured while about to enter a train of defendant. The train had come to a full stop, and the conductor having cried, "All aboard," plaintiff was in the act of passing from the station platform to the car platform, when the car gave a violent jar, which threw her down. The Supreme Court holds the railroad liable.[12]

The Supreme Court of Main holds that damages are not recoverable for injury to a passenger who, while standing on the platform of a car, was thrown therefrom by a lurch of the train in rounding a curve, although he was not warned of the danger of his position, his ticket was taken while he was standing there, and the day was hot and the cars dusty and uncomfortably crowded.[13]

In Texas the Supreme Court holds that it is not contributory negligence for a passenger on entering a railroad car while it is running over a rough roadbed to rest his arm in an open window to steady himself without first examining the window to see if it is secure against falling on account of the jolting of the train.[14]

The Federal Court of Appeals decides that where it is the duty of the section men to remove coal or coke from the tracks of a railroad company, and they negligently fail to do so, a switchman who, in coupling cars, stumbles on coal so left on the track and is injured, cannot recover, since he and the section men are coservants.[15]

In Colorado, B., a general agent, was in charge of the tracklaying for a railroad company, a distinct department of the construction work. He had under him five different gangs of men employed in different branches of tracklaying, each gang having its particular foreman, and had authority to hire and discharge both the foremen and the workmen, and controlled the trains, cars, tools, and other implements used in tracklaying. He was subject to the superintending direction of N. when present, but during N's absence he had supreme control over his department. A member of the gang engaged in bedding the ties was injured in the derailment of a train on which he was riding to work, and which was caused by obedience of the spiking gang to B.'s direction concerning the number of spikes to be used. N. was absent at the time. The Supreme Court holds that B. was a vice principal, and not a fellow servant of the injured man, and that the railroad is liable.[16]

In Alabama the Supreme Court holds that for a foreman in charge of a hand car, knowing that those operating it were at times in the habit of turning loose the lever when the car was running down grade, to apply the brakes so as to check with unnecessary and dangerous suddenness the speed of the car when so running, without notice to the operators and without looking to see that they were holding the lever, and at a place where it was not customary to stop, is negligence.[17]

[1] Emerson v. St. L. & H. R. C., 19 S. W. Rep., 1,113.
[2] Hancock v. L. & M. R. Co., 12 S. C. Rep., 939.
[3] Perry County Railroad Extension Co. v. Newport & S. V. R. Co., 24 Atl. Reps. 709.
[4] Central Trust Co. v. W., St. L. & P. Ry. Co., 50 Fed. Rep., 857.
[5] State v. H. St. J. R. Co., 19 S. W. Rep., 816.
[6] Storrs v. P. & A. R. Co., 11 South. Rep., 226.
[7] St. L. V. & T. R. Co. v. T. H. & I. R. Co., 12 S. C. Rep., 953.
[8] St. Louis A. & T. Ry. Co. v. Neel, 19 S. W. Rep., 963.
[9] T. H. & I. R. Co. v. Schaeffer, 31 N. E. Rep., 557.
[10] A. & W. P. R. Co. v. Dickinson, 15 S. E. Rep., 534.
[11] Cook v. L. I. R. Co., 19 N. Y. S. 648.
[12] Goodwin v. B. & M. R. R., 24 Atl. Rep., 816.
[13] Gulf, C. & S. F. Ry. Co. v. Killebrew, 20 S. W. Rep., 184.
[14] C., S. O. & T. P. Ry. Co. v. Mealer, 50, Fed. Rep., 725.
[15] Col. Mid. R. Co. v. Naylor, 30 Pac. Rep., 249.
[16] Kan. City, M. & B. R. Co. v. Crocker, 11 South Rep., 225.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago, St. Paul, Minneapolis & Omaha, semi-annual, 3½ per cent., on the preferred stock, payable Jan. 30.

Fitchburg, annual, 2 per cent., on the preferred stock, payable Jan. 16.

Lehigh Valley, quarterly, 1½ per cent., payable Jan. 16.

Norfolk & Southern, quarterly, 1 per cent., payable Jan. 10.

Norwich & Worcester, semi-annual, 4 per cent., payable Jan 5.

Oregon Railway & Navigation Co., quarterly, 1½ per cent., payable Jan. 1.

Rio Grande Western, quarterly, 1¼ per cent., payable Jan. 1.

Worcester, Nashua & Rochester, semi-annual, $3 per share, payable Jan. 2.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Barclay, special, Philadelphia, Jan. 16.
Brooklyn Elevated, annual, Brooklyn, N. Y., Jan. 4.
Cleveland & Pittsburgh, annual, Cleveland, O., Jan. 4.
East Mahanoy, annual, Philadelphia, Pa., Jan. 9.
Indiana, Illinois & Iowa, annual, Kankakee, Ill., Jan. 18.
Kingston & Pembroke, special, Kingston, Ont., Dec. 31, to authorize the issue of first preference five per cent. bonds.
Malone & St Lawrence, special, New York City, Jan. 16, to take action upon a proposition to lease the road to the Central Vermont.
Philadelphia & Reading, annual, Philadelphia, Pa., Jan. 9.
Rome, Watertown & Ogdensburg, annual, New York City, Dec. 28.
Terre Haute & Peoria, annual, Decatur, Ill., Jan. 18.
Toledo & Ohio Central, special, Toledo, O., Dec. 31.
Western New York & Pennsylvania, annual, Philadelphia, Pa., Jan. 9.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New England Railroad Club* holds regular meetings, at the United States Hotel, Beach street, Boston, Mass., on the second Wednesday of each alternate month commencing January.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at 7:30 p. m., at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at Wesleyan Hall, Bromfield street, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetingsat the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

The *Engineers' and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

American Society of Civil Engineers.

At the meeting held on Dec. 7, a paper on "The Use of Asphaltum for Reservoir Linings," by James D. Schuyler, was read by the Secretary and discussed, as noted in a previous issue.

A paper was also read by W. B. Parsons, M. Am. Soc. C. E., on

BORINGS IN BROADWAY, NEW YORK,

and discussed by Messrs. Flagg, Brush, Collingwood, C. W. Hunt and the author. These borings extended from South Ferry to Thirty-third street, and were made in 1891 for the Rapid Transit Commission. A test hole was put down at every street crossing. An iron sounding rod was first driven to be sure that there was no obstruction in the way near the surface. Then a 2-in. casing was driven by a portable pile-driver, consisting of a hammer weighing 150 lbs., with a fall of 6 ft., and running on four light iron guides. Into this a ¾ in wash pipe with a chisel point was forced by the discharge of water through it. Samples of the sand and other material washed up by the water through the space between the two pipes were retained and depth noted. It was found that in coarse sand the casing had to be carried nearly to the bottom of the hole, while in fine material it would be left far above it—in one case 185 ft. The total of the depths of the holes was 1,118 ft., and the total of the depths to which the casing was driven was 2,755 ft.

There were 62 holes varying from 7 ft. to 163 ft. in depth, the average being about 65 ft. The average time spent on each hole was about 12½ hours, and about 11 minutes per foot of depth. It is not claimed that rock was reached in all cases, but the results show the nature of the material passed through, and that there is no rock for the depth penetrated.

SEWERAGE.

At the meeting of Wednesday, the 21st, a paper was read by Mr. Uroan H. Brougton, on "The Shone Hydro Pneumatic System of Sewerage." The writer mentions the extent of the use of this system, and then gives the cases where it may rightly be used, under seven heads, which may be summed up as those where no natural outlet can be obtained, those where the cost of obtaining an outlet would be prohibitory and those where quick removal or other reasons render its use desirable. The system is described as one in which the motive power is compressed air, automatically acting directly upon the sewage. It uses a minimum of water, and the apparatus is so arranged that no strainers are required; hence it is much less troublesome than pumps. It allows the sewerage districts to be subdivided at will, and thus limits the spread of epidemic diseases. Through its use the sewers are self-cleansing. The pneumatic system is very effective in the drainage of large buildings, where the basements are below the level of the sewers in the streets. There is an absolute barrier in such cases from a reverse flow of sewerage or sewer gas from the street to the building. A case is mentioned of such an installation having been in use in Chicago for two and one-half years without a single stoppage.

The writer describes the system as applied to the drainage of Rogers Park, Ill., a suburb of Chicago, and the systems at Winona, Minn., and the Columbian Exposition at Chicago, are also described. The latter provides for between 3,000 and 4,000 water closets, urinals, and wash-basins. There are 26 ejector stations, varying in capacity from 60 to 600 gals. per minute, and having a united capacity of 17,000,000 gals. in 24 hours; and, with ten exceptions, this is a larger plant than would be required for the removal of the sewage of any city in the United States. The minimum grades are 1 in 250. Vitrified sewer pipes 2½ ft. long, and with deep sockets, are used. The compressing plant is fully described. There are 5 miles cast-iron air pipes 2 to 10 ins. in diameter, laid at an average depth of 4½ ft. There are 4⅞ miles of cast-iron sewage discharge pipe of from 6 to 30 ins. diameter. The maximum lift of the sewage is 67½ ft., and the maximum total head pumped against is 107¾ ft. The air pipe line was tested to 90 lbs. after laying without appreciable loss, and the pressure maintained will be 47 lbs. to the square inch. There are four wrought iron receiving tanks 32 ft. in diameter and 55 ft. high, in which the solid matters will be precipitated by chemicals, and afterward pressed into cakes and burnt. The effluent will be run into the lake.

Rensselaer Polytechnic Institute.

A lecture on Aluminum was delivered Dec. 15 before the students of the Rensselaer Polytechnic Institute at Troy, by Maj. Alfred E. Hunt, the President of the Pittsburgh Reduction Company.

PERSONAL.

—Mr. W. S. Pope, Assistant Superintendent of the Chicago, Rock Island & Pacific at Topeka, Kan., resigned last week.

—Mr. E. H. Miller, Secretary of the Central Pacific, died Dec. 21, at Alameda, Cal. He was born at Greenwood, N. Y.

—Mr. James Ludlam, President of the Pompton Iron & Steel Works, died suddenly of heart disease Dec. 20 at Pompton, N. J., aged 64 years.

—Mr. E. C. Kennan, formerly Resident Engineer of the Union Pacific in Denver, has accepted the position of Chief Engineer of the Imperial Railway of China.

—Mr. E. A. Peck, General Superintendent of the Cleveland, Cincinnati, Chicago & St. Louis, has resigned. The office has been abolished and the duties assigned to Joseph Ramsey, Jr., General Manager.

—Mr. H. A. Fisher, who was formerly General Manager of the St. Louis, Alton & Springfield, has been appointed General Manager of the Louisiana, Arkansas & Missouri road which, it is reported, will do considerable construction work next year. His office is at St. Louis.

—Mr. Leonard Crossman, who was for many years connected with the Central of New Jersey, for some time as Master Mechanic at Elizabethport, N. J., died at Elizabeth, N. J., on Dec. 15 in his seventy-eighth year. He has not been in business for some years.

—Mr. D. O. Ives who has been Assistant General Freight Agent of the Hannibal & St. Joseph, the Kansas City, St. Joseph & Council Bluffs, has been appointed General Passenger and Ticket Agent to succeed Col. A. C. Dawes who has resigned on account of ill health.

—Mr. Henry C. Gould, son of Mr. Charles A. Gould, of the Gould Car Coupler Co., and Vice-President of that company, died at Buffalo, N. Y., this week, after a long illness. He became identified with his father's business several years ago, when about 21 years of age, and has had charge of the Buffalo works since the removal of Mr. C. A. Gould to New York.

—Mr. John T. Knight who was elected President of the Thomas Iron Company this year to fill the vacancy caused by the death of Mr. Benjamin Clarke, died suddenly at his home at Easton, Pa., Dec. 16. Mr. Knight had been connected with the Thomas Iron Company since its organization, and was Treasurer of the company for over 25 years until his election to the presidency a few months ago. He was President of the Eastern & Northern Railroad, and was Director in a number of financial and manufacturing companies.

—Mr. J. N. DuBarry, Second Vice-President of the Pennsylvania road, died suddenly at his home in Philadelphia on Dec. 17.

Joseph Napoleon DuBarry was born at Bordentown, N. J., on Nov. 30, 1830. His father was Edmund L. DuBarry, a surgeon in the United States Navy, and his mother, who survives him, was the daughter of William Duane, who was editor of the Philadelphia *Aurora*. After attending the schools in his neighborhood, young DuBarry was sent to Washington, where he acquired his classical education. In June, 1847, when only 17, he entered the service of the Pennsylvania Railroad, being employed in the engineering department as a rodman. For three years he was engaged on the preliminary surveys and location of the Pennsylvania road between Altoona and Pittsburgh, the most mountainous section on the whole road. The difficulties in the construction of the road over the main ridge of the Allegheny Mountains were great, and these three years spent in the then mountain wilderness of Western Pennsylvania, served as an invaluable school for the young man, and developed not only the skill but the strength of purpose and fertility of resources which made him capable of assuming and faithfully discharging the great responsibilities which were afterwards placed upon him. In 1850, Mr. DuBarry was made Assistant Engineer of Construction. From May, 1852, to May, 1853, he was Principal Assistant Engineer of the Sunbury Division of the Sunbury & Erie, having charge of surveys and location of new lines. From May, 1853, to the spring of 1856, Mr. DuBarry was Principal Assistant Engineer of the North Pennsylvania, during its location and construction. For a short time in the winter or spring of 1856, Mr. DuBarry was Assistant Engineer of the Sand Patch tunnel of the Pittsburgh & Connellsville road. In May, 1856, he was appointed Principal Assistant Engineer of the Southwestern Branch of the Pacific Railroad of Missouri, which position he held until September, 1858, when he again returned to the service of the Pennsylvania as Superintendent and Engineer of the Western Division of the Pittsburgh, Fort Wayne & Chicago, which was built through to Chicago under his direction. Upon the completion of this work Mr. DuBarry was made Superintendent of the Western Division, extending from Crestline to Chicago, 280 miles. He held this position until December, 1861, when he was appointed General Superintendent of the Northern Central, filling this responsible position with great credit to himself and the company during the exciting period of the War of the Rebellion. At that time the Northern Central was a main artery through which troops and provisions were transported to the Union Army in the South. To prevent the road falling into the control of the Confederate Army under General Lee, in its march into Pennsylvania in the Gettysburg campaign, which would have given Lee an opening towards Harrisburg and Philadelphia, all the bridges on the York Division, some twenty in number, including the long Columbia Bridge, were destroyed, and upon Mr. DuBarry devolved the important work of their reconstruction. After the battle of Gettysburg, General Superintendent DuBarry was one of the first to respond to the cry for assistance for the thousands of wounded soldiers on the field. Fitting up a relief train, he started with it from Baltimore for the scene. Innumerable difficulties confronted him on his errand of mercy, but all were overcome, and when he returned to that city he carried hundreds of the wounded. In July, 1867, Mr. DuBarry was elected Vice-President of the Northern Central, and Baltimore & Potomac roads, and removed from Harrisburg to Baltimore. While occupying this responsible position he had under his supervision the construction of the Baltimore & Potomac tunnel under the City of Baltimore, a difficult and costly piece of work. On Feb. 24, 1875, Mr. DuBarry was elected Assistant to the President of the Pennsylvania, his duties being to assist the President in all engineering questions pertaining to the construction or improvement of any of the properties owned or operated by the company. On Oct. 1, 1882, Mr. DuBarry was promoted to the position of Third Vice-President, having general supervision of all construction work. He also had charge of the promotion and construction of all new lines in which the Pennsylvania was interested. During his service as assistant to the President and as Third Vice-President, Mr DuBarry directed the construction and reconstruction of many railroads. The revision of the line and grades of the Western Pennsylvania occupied his attention for several years. One of the longest lines, and perhaps the most important, constructed under Mr. DuBarry's direction, was the Pennsylvania Schuylkill Valley road, which was completed in 1885. This road extends from Philadelphia up the Valley of the Schuylkill River to the top of Broad Mountain, beyond Pottsville, Pa., a distance of over 100 miles, and now forms a division of the Pennsylvania system. He also built the Germantown & Chestnut Hill road and the Trenton Cut-Off. On the resignation of Edmund Smith as First Vice-President of the Pennsylvania, on June 30, 1888, Mr. Frank Thomson was appointed to fill the vacancy, and Mr. DuBarry was elected Second Vice-President. As Second Vice-President Mr. DuBarry had under his direction the treasury and insurance departments of the Pennsylvania, and had general supervision of all the financial matters of the numerous corporations in which the Pennsylvania had a pecuniary interest. He also had charge of all construction work. At the time of his death Mr. DuBarry was a director in over 60 different corporations in which the Pennsylvania Railroad Co. had an interest, and was also President of many of the controlled and anxiliary companies. Mr DuBarry was a member of the American Society of Civil Engineers, and also of the Institute of Civil Engineers of England.

Mr. DuBarry left his office on Thursday afternoon of last week. On Friday, not feeling very well, he remained at home. On Saturday morning he arose at the usual hour with the intention of coming down to his office, and while dressing was suddenly seized with a fainting spell. He quickly rallied, however, but a second attack followed almost immediately, and he sank to the floor unconscious. Before a doctor could be summoned he passed away. A valvular affection of the heart is said to have been the cause of death. Funeral services were held on Monday afternoon in the Second Presbyterian Church. On Monday evening his remains were taken on a special train to Pittsburgh, where they were interred, after a brief service, in the Allegheny Cemetery. The remains were accompanied by the pall-bearers, who were: President Geo. B. Roberts, Vice-Presidents Thomson and Green, General Manager Pugh, Assistant General Solicitor James A. Logan, James McCrea, Robert Pitcairn, A. W. Sumner, Samuel Rea, W. H. Barnes, Gen. W. J. Sewell, F. Wolcott Jackson, N. Parker Shortridge and Henry D. Welsh.

Mr. DuBarry held the respect and admiration of his superiors as well as his subordinates. As a practical railroad man he had few equals. As a private individual he was held in high esteem, his nature being such as to make him a favorite among a large circle of friends. He possessed a strong and distinctive personality, a genial and pleasant temperament, and a rugged honesty, traits which were apparent throughout his lifetime, at his office and at his home. Mr. DuBarry was married in 1858 to Miss Denny of Pittsburgh, daughter of an officer of the United States Army, who survives him. There are also two daughters and a son, the latter of whom is Supervisor of the Lewistown Division of the Pennsylvania. Mr. DuBarry was a brother of Gen. Beekman DuBarry, formerly Commissary General, U. S. A., and also a brother of E. L. DuBarry, Superintendent of the Norfolk & Western.

ELECTIONS AND APPOINTMENTS.

Atlantic & Danville.—The annual meeting was held at Portsmouth, Va., Dec. 20. The following officers were elected: President, B. Newgass, of London, Eng.; Vice-President, Bernard Bruen, of Portsmouth; Secretary, P. G. Chamberlain. Board of Directors, B. Newgass, David Lehman, Isaac L. Rice, Jonas M. Libbey, R. B. Tunstall, Bernard Bruen, Alfred P. Thom, George M. Hughes and R. C. Marshall. There were 35,013½ shares of stock represented.

Boston & Maine.—The new directors have organized by the election of A. A. McLeod, President, and Frank Jones, Chairman of the Board.

Calumet & Blue Island.—H. A. Hausgen, late Assistant General Freight Agent of the Iowa Central, has been appointed Assistant General Freight Agent of this road with office in Chicago.

Chicago, Rock Island & Texas.—S. B. Hovey has been appointed Vice-president and General Superintendent, and J. C. McCabe General Ticket, Freight and Passenger Agent for Texas, with office at Bowie, Tex.

Colorado Midland.—B. H. Bryant has been appointed Superintendent, with headquarters in Colorado Springs, Col., in place of W. J. Lawrence, resigned. E. E. Rittenhouse has been made Assistant Superintendent of the First Division and J. C. Bowdish Assistant Superintendent of the Second Division.

Georgia Pacific.—At the annual meeting at the Birmingham, Ala., the following directors were elected: Joseph Bryan, Robert Jemison, John G. Moore, William H. Perkins, W. P. Glyde, J. C. Maben, W. G. Oakman,

J. A. Rutherford and George F. Stone. Joseph Bryan is President.

Housatonic.—At a meeting of the stockholders Dec. 20, the following directors were chosen: A. R. Mygatt, Charles Lanier, William Rockefeller, J. Pierpont Morgan, Charles P. Clark, Lucius Tuttle, W. E. Barnett and Milo P. Richardson. Officers were elected as follows: President, G. Macculloch Miller; Vice-President, W. E. Barnett; Treasurer, C. E. Robinson; Secretary, M. E. Stone.

Houston & Texas Central.—J. C. Kidd has been appointed Auditor, vice H. Hall, deceased. F. K. Derrance has been appointed Tie and Fuel Agent. Mr. Kidd has been in the employ of the road for the past 18 years and the position of Assistant Auditor prior to his appointment as Auditor.

Kearney & Black Hills.—The Company has elected the following officers; S. H. H. Clark, President; J. H. Lathrop, Vice-President and Acting General Manager; James Harris, Treasurer.

Knox & Lincoln.—At the annual meeting this week the following Directors were chosen: John T. Berry, Rockland, Me.; E. O. Clark, Waldoboro, Me.; Edwin Hoggett, Newcastle; Henry Ingalls, Wiscasset; J. G. Richardson, Bath, Me.

Mankato & Northeastern.—At the annual meeting of stockholders, on Dec. 14, the following directors were elected: P. H. Carney, Henry Robel, J. G. Fowler, D. L. Rose, John Klien, P. Fallman, Thomas Coughlan, F. Kron, O. Cassidy, I. N. Finigan, of Mankato, Minn.; Peter Kremer, of Minnesota Lake; T. S. Wilcox, of Kasota; J. W. Chambers, of Cleveland; Jacob Krenik of Le Sueur Center; Joseph M. Kremer, of New Market. The directors elected the following officers: P. H. Carney, President; Henry Robel, Vice-President; J. G. Fowler, Secretary, and D. L. Rose, Treasurer.

Mexican National.—E. N. Brown has been appointed General Superintendent in charge of the operation of the line, to succeed T. D. Kline, General Manager, who has resigned, as stated last week. The other duties of the General Manager will be assumed by the Second Vice-President and Treasurer, G. Morton, whose office is at the City of Mexico.

New Haven & Derby.—The annual meeting of the stockholders was held Dec. 20, and directors elected as follows: Charles P. Clark, President of the New York, New Haven & Hartford roads; J. Pierpont Morgan, Lucius Tuttle, William Rockefeller, S. E. Merwin, Franklin Farrell, Al. E. Barnett, N. D. Sperry and Thomas Wallace. The officers elected are: President, Lucius Tuttle; Vice-President, C. P. Clark; Treasurer, C. E. Robinson; Secretary, A. J. Porter.

New York Central & Hudson River.—The office of General Freight Traffic Agent, with such duties as may be assigned thereto by the Second Vice-President or General Traffic Manager, has been created, to take effect Jan. 1, 1893. The following promotions and appointments have been made, to take effect the same date: Samuel Goodman, now Assistant General Freight Agent, to be General Freight Traffic Agent; William L. Kingman, now General Coal Agent, to be Assistant General Freight Agent in place of Samuel Goodman, promoted. The office of General Coal Agent of the New York Central Co. is abolished. These changes do not affect Mr. Kingman's position as General Coal Agent of the West Shore and the Rome, Watertown and Ogdensburg.

New York & Northern.—H. H. Vreeland has been appointed General Manager, the office of General Superintendent having been abolished. Mr. Vreeland's headquarters will remain at High Bridge, N. Y.

Northeastern Elevated.—The board of directors of the company are: Charles W. Buchholz, President; James A. Wright, Isaac Schlichter, V. C. Sweatman and George Boker, all of Philadelphia; W. A. Read, F. B. Esler and Edward Lauterbach, New York, and Gen. James Jourdan, Brooklyn.

Northern Pacific.—The position of General Manager's Secretary, having become vacant by the death of H. C. Wilson, F. J. Shephard has been appointed Chief Clerk of the General Manager's office, and is authorized to countersign requests on foreign roads for transportation and to issue this company's transportation over his countersignature.

Paducah, Tennessee & Alabama.—The annual meeting was held at Paducah, Ky., Dec. 7, John T. Davis, Thomas H. West, William L. Huse, Alvah Mansur, Daniel Catlin, John A. Scudder, T. J. Moss, J. H. Allen, of St. Louis; John Overton, Jr., Memphis; A. B. Lamb, Paris, Tenn.; T. H. Puryar, Paducah, Ky.; E. B. Johnston, St. Elmo, Ill., were elected Directors.

Quaker City Elevated.—The following is a list of the directors: Charles W. Buchholz, Philadelphia, President; August Belmont, R. M. Gallaway and W. A. Read (Vermilyea & Co.), of New York City; Gen. James Jourdan, Brooklyn, and Thos. S. Harrison, Chas. B. McMichael, Geo. M. Woodward, Ellis Lea, Alfred C. Harrison and Geo. Boker, of Philadelphia.

Santa Fe Southern.—The following directors were elected at the annual meeting: C. H. Eicks, S. F. Sullivan, C. A. Bromley, E. R. Leland, of New York; T. B. Catron, R. W. Webb, John Symington, of Santa Fe. The only change is the retirement of C. H. Chilton, of New York, and the election in his stead of R. W. Webb. The election of officers took place at New York City. R. Chapman was elected President, New York; T. B. Catron, Vice-president, Santa Fe, N. Mex.; C. H. Eicks, Secretary and Treasurer, New York; T. J. Helm, General Superintendent, Santa Fe.

Texas Central.—The following are the directors named in the new charter filed in Texas last week: Charles Moran, C. B. Gould, of New York; Henry K. McHarg, of Stanford, Ct.; James H. Oliphant, Osgood Welsh, Joseph A. Davidson, William D. Barbour, John M. Shedd, A. D. Moran and Rudolph Ross, Jr., all of New York and Brooklyn.

Union Pacific.—The vacancies in the Board of Directors caused by the deaths of Jay Gould and Sidney Dillon have been filled by the election of George J. Gould and Sidney Dillon Ripley, the latter a grandson of Sidney Dillon.

Wabash.—Robert Kelly, for several years City Ticket Agent of the Ohio & Mississippi Railroad at St Louis, has been appointed District Passenger Agent of this road at Louisville, succeeding R. M. Fowler resigned.

Wyoming & Utah.—The incorporators are Charles A. Sherman and E. S. Weatherby, of Iowa; Ormond Rambo, of Philadelphia; A. C. Smith, of Suffolk, Va., and J. A. Van Horn, of Lincoln, Neb.

RAILROAD CONSTRUCTION.

Incorporations, Surveys, Etc.

Astoria & Eastern.—The company has been incorporated in Oregon to build a road from Astoria, via the Nehalem River Valley, to Portland, with a branch to Oswego, and to acquire the road now built from Young's Bay to Seaside. Evidently the intention is to complete the Astoria & Portland, work on which was recently suspended. The capital stock is $3,000,000, and the incorporators are I. W. Case, W. H. Wattis and F. J. Taylor.

Baltimore & Ohio.—The company has decided to make an improvement on its Pittsburgh-Wheeling division, which has been talked of for several years. The distance from Miller's Grove to Wilson's Station is five miles. The line has many curves and the grades are the heaviest on the division, and helping engines are constantly used. It has been decided to make a short cut through the hill by building a 1,700-ft. tunnel, shortening the route three miles and reducing the grade to the minimum. It is estimated that the improvement will cost about $200,000. The plans are all prepared and the work will probably begin as soon as good weather sets in.

Brainerd & Northern Minnesota.—The first 40 miles of this road from Brainerd, Minn., has been completed and accepted, on the recommendation of W. W. Rich, Chief Engineer of the Minneapolis, St Paul & Sault Ste. Marie. The road thus obtains the bonus of $100,000 in bonds voted to aid its construction by Crow Wing County, Minn.

British Columbia Roads.—McPhillips, Wooton & Barnard give notice that they will apply to the British Columbia legislature for an act to incorporate a company to build a road from Okanagan Lake to a point on the Kettle River where it crosses the international boundary.

The same firm will apply for an act of incorporation for a company to build from Lardeau City, B. C. at the head of the northeast arm of the upper Arrow Lake, thence through Lardeau pass to some point on the northwest shore of Lake Kootenai.

Canadian Roads.—Application will be made to Parliament at its next session to incorporate the Atlantic & Pacific Co., to build, as announced in the daily papers, from Sault Ste. Marie to the Gaspe Basin, through the districts of Algoma and Nipissing and following the Ottawa River through the counties on the south side of the River St. Lawrence.

Charleston, Clendenin & Sutton.—Work on this line, which is to be completed from Charleston, W. Va., to Clendenin, in the same state, this winter, is now being pushed rapidly. The grading will be finished, with fair weather, by Jan. 15, and the track is now completed and in use from Charleston to Fallen Rock, on the Elk River, 15½ miles from Charleston.

Chicago, Evanston & Indiana.—Articles of incorporation for the company were filed this week. The company proposes to construct a road from a point on Lake Michigan near the northern city limits of Chicago westerly and southwesterly, crossing the canal between the western limits of Chicago and the western limits of Cook County, thence south and east, intersecting the State lines of Indiana and Illinois in Cook County. The capital stock is $5,000,000, and the incorporators are: J. W. Taylor, John G. Watson, Newton P. K. Hatch, John Davis and David Williams.

Columbia & Kootenai.—The company will make application at the next session of the Provincial Parliament to construct an extension from a point on its present line to Revelstoke, B. C., and other branches not exceeding 30 miles.

Dakota, Wyoming & Missouri River. President W. T. Coad, has returned to Rapid City, S. D., from a trip to the east on financial business. He states that he has made arrangements for pushing forward the work on the line, and that the grading will be resumed in a short time west of Rapid City, S. D.

De Kalb, Chicago & Great Western.—Articles of incorporation were filed in Illinois this week. It is proposed to build a road from De Kalb to Sycamore, both in De Kalb County. The capital stock is $15,000, and the incorporators are: Charles E. Bradt, Edward C. Lott, Duane J. Carnes and others.

Denver & Rio Grande.—The company is making slow progress on its extension from Crested Butte, Col., owing to the heavy snow. The line is being built to the Colorado Marble Co.'s quarries, about 15 miles distant.

Dry Fork.—A charter was issued last week to this company, organized for the purpose of constructing a road, to begin near Bretz, in Tucker County, W. Va., and extend southwest along Cheat River through the valley of either Glade Fork or Dry Fork to the headwaters of Greenbrier River, in Pocahontas County and thence, southerly, through Pocahontas and Greenbrier counties, to the Chesapeake & Ohio road, near Caldwell, in Greenbrier County, with branches up the Red Creek and tributaries of Cheat River. The principal office will be at Bretz, Tucker County. The capital is $100,000. The incorporators are: Martin Lane, Wilmington, Del., Levi C. Condon, Baltimore; John L. Hummell, Philadelphia; J. B. Rees, Rees' Tannery, W. Va.; R. F. Whitmer, Philadelphia, Pa.

Eau Claire, Chippewa & Superior.—The company has filed articles of incorporation in Wisconsin, with H. C. Putnam, John Owen, Capt. E. S. Clark, B. A. Buffington and R. E. Rust, all of Eau Claire, Wis., as incorporators. A partial survey of the road has been made. It will be a continuation of what is known now as the Chippewa Valley division of the Chicago, Milwaukee & St. Paul, the terminus of which is Chippewa Falls, through the Chippewa Valley.

Ellensburg & Northwestern.—Mortgage bonds have been issued on the property of the railroad, consisting of right of way and 11 miles of graded road, and a representative has gone East to try to secure funds to continue the construction work on the line which is projected from Ellensburg, Wash., west to the Columbia River.

Florence, Cripple Creek & State Line.—President W. E. Johnson has left Denver for New York City and is hopeful of arranging for the early construction of the line as surveyed. The route is about 40 miles long, from Florence, Col., reaching the mines in Fremont County, Col., and connecting with the Cripple Creek mines.

Glendon & Gulf.—The Glendon & Gulf Mining & Manufacturing Co. has under construction a road between Gulf and Fair Haven, N. C., ten miles. All of this line is graded with the exception of about two miles, but no track has yet been laid on account of delay in receiving the rails. The company is doing its own work. Frank D. Jones, of Gulf, N. C., is Chief Engineer.

Grand Trunk.—A branch of one mile to Cote St. Paul, Que., it is expected will be put in hand next spring. It leads from the main line of the Grand Trunk Railroad adjacent to the city of Montreal to the manufacturing village of Cote St. Paul, which is a suburb of the city.

Great Northern.—The last report of the tracklaying on the Pacific extension, showing the progress of the work to Dec. 12, states that only 20 miles of track remained to be laid to complete the work. The end of track was at the 65-mile post, east of Lowell, Wash. On the east side the end of track was at Tunnel City, at the foot of the switchback. This leaves a gap of about 20 miles—11 on the switchback and 8 west of it. At the present rate of progress tracklaying will be completed by Jan. 1 at the latest.

Jacksonville, St. Augustine & Indian River.—Louis McLain, the contractor for the southern extension now being built to the Indian River, has the track laid for about 15 miles south of Titusville, Fla., where the road reaches Indian River which it follows for the remaining distance to Rock Ledge, Fla.

Kaslo & Slocan.—Hon. John Hendry, of New Westminster, B. C., one of the principal owners of the townsite at Kaslo, B. C., and President of the railroad company, has had engineers make a survey, now about completed, for a road from Kaslo City, in the Kootenay mining region, to the junction of Carpenter and Cody Creeks by way of Bear and Fish Lakes. It will be about 30 miles in length. The prospects are now fairly good for its being constructed next summer. The building of the road depends upon the development of the mines. It is reported that there are now about 19 mines shipping ore over the wagon roads to Kootenay Lake.

Mexican Roads.—A concession has been obtained by Chopin Brothers, who are understood to represent a syndicate of United States capitalists, for a proposed road from Esperanza, a thriving town on the Mexican (Vera Cruz) Railroad, to Suchil, a small place in the State of Vera Cruz. The country traversed by this route is a rich agricultural section. The concessionaires have deposited in the National Treasury a guarantee to the Government for the performance of the contract.

Midland Terminal.—It is now announced that the road will be running into Cripple Creek, Col., by Feb. 1. About three-fourths of the grading between Divide and the town of Midland and about one-half between Midland and the mining camp is completed. The ties are already on the ground; the rails are being rolled and the rolling stock is about to be contracted for.

Monterey & Streets Run Connecting Railroad Co.—The charter for this company was issued on Dec. 19. The road is to start from the village of Monterey, Allegheny County, Pa., on the Pittsburg, Virginia & Charleston road, thence easterly and along the southerly bank of the Monongahela River, crossing the Pittsburgh, McKeesport & Youghiobeny and the Pittsburgh, Virginia & Charleston, to the Wheeling Division of the Baltimore & Ohio. The capital stock is $20,000. Robert A. Carter, Pittsburgh, Pa., is President, and W. M. Rees, David A. Rees, Henry L. Brent, James McAfee and E. G. Furgerson, all of Pittsburgh, directors.

Muncie Belt.—The work of building this road has been suspended on account of legal difficulties. It is a belt line at Muncie, Ind., being built for the Cleveland, Cincinnati, Chicago & St. Louis, nine miles long, of which two miles were under construction.

Natchitoches.—The grading on the extension from Natchitoches, La., to Grand Ecore, about 10 miles, has been completed, and also the tracklaying, Martin & Gray being the contractors for the former work and John Brogan for the tracklaying. W. B. Allen was engineer in charge.

Nevada Southern.—The route of this road, recently incorporated in Colorado, as already noted, is given in the charter as follows: From Goff, San Bernardino County, Cal., west of The Needles to Good Springs, Lincoln County, Nev., via Goff, Von Trigger, Manvel, Vanderbilt, Ivanpah in San Bernardino County, Cal., and State Line and Good Springs, Lincoln County, Nev., with branch lines from Manvel to the New York mining district, and from State Line to Mesquite Valley, over the State Line Pass. The length of the road is 100 miles. I. E. Blake, of Denver, President of the road, has recently returned from New York City where he is reported to have made arrangements to bond the road for $15,000 a mile at 5 per cent., the Metropolitan Trust Co. to be trustee of the bonds. The company expects to complete 50 miles by Feb. 1, 1893, and a contract for the shipment of 100 tons of ore a day from that terminus has been signed. The work will not be done by contract. The directors are: I. E. Blake, of Denver; Demetrius G. Scofield, of San Francisco; Walter F. Crosby, of Colorado Springs; Frank L. Morgan and Otto Amsden, of Needles, Cal., and William L. Beardsley and George C. Manley, of Denver. R. S. Seibert is General Manager.

North Galveston, Houston & Kansas City.—The bridge over Dickinson Bayou, which has delayed the progress of the road, was completed last week, and construction trains are now running over it. The grading has been completed on the 18 miles between Virginia Point and North Galveston, with exception of the last four miles near North Galveston, and the track will be laid in a few weeks. The contract has been let for the extension of the line to Clear Creek, where connection is to be made with the La Porte, Houston & Northern which is to be extended to that point from La Porte. This connecting line will be about 15 miles long and each company will build about half the distance.

Orford Mountain.—The road is now completed from Eastman, Que., on the Canadian Pacific north to Kingsbury, Que., a distance of 26 miles. The line has been inspected by the engineers of the Provincial and Local governments, the company having subsidies from both governments. The contractors are C. C. Smith & Co., of Montreal, who have built 16 miles this season. The proposed terminus is at Richmond, Que., north of Kingsbury, but no further work is proposed at present. It will be necessary to build a bridge over the St. Francis River at a cost of about $75,000 to reach Richmond.

Pennsylvania & Northwestern.—The second track built this year, between Bellwood, the southern ter-

minus, and Irvona, Pa., was opened for traffic on Dec. 19. The first seven miles of the double track, from Irvona to Glasgow, was built early in the year, and the balance has been built during the fall. A new line called the Mahoning Branch was also opened this week between Horatio and Fordham, Pa. The new road is, practically, an extension of about three miles beyond the present terminus.

Philadelphia & Reading.—It is stated that work has been begun by a small force under the direction of the company's officers for a new road between Harrisburgh and Rockville, Pa., a distance of about five miles. The Pennsylvania tracks are now used between these points. The intention is to build a connection between the Schuylkill & Susquehanna ranch and the line which crosses the Susquehanna River at Harrisburgh, so as to give a better outlet to the West for the coal traffic originating at Pottsville. This traffic is now sent in a roundabout way over the Lebanon branch. A tunnel will be necessary to reach Rockville.

Potomac & Appalachain.—A charter was issued in West Virginia last week to this company to build a line from a point in Mineral County, W. Va., opposite Cumberland, Md., in a southerly direction along Paterson Creek to Petersburgh, in Grant County; thence up Mill Creek Valley and along the south branch of the Potomac River to Franklin, in Pendleton County, W. Va. Branches are proposed from Petersburgh via Moorefield to connect with the Baltimore & Ohio at Romney, in Hampshire County. The incorporators are George Crusman and W. W. J. Cowger, of Rockingham County, Va.; William C. Kiser, of Franklin, Pendleton County, W. Va., and J. T. Kile, of Upper Tract, Pendleton County, W. Va.

Springfield, Sedalia, Marshall & Northern.—A bonus of $100,000 has been subscribed in Springfield, Mo., to aid this road, and subsidies have been secured from a number of other towns on the surveyed route through Missouri.

Spokane Falls & Northern.—The contracts for the extension from Northport, Wash., to the international boundary were awarded last week by Chief Engineer Roberts, and work on the extension has been commenced, and will be continued through the winter on rock work. This is the first section of the extension to Kootenay, B. C. The line in British Columbia is called the Nelson & Fort Sheppard. Northport, the present northern terminus of the road, is about 10 miles south of the boundary, and the objective point of the extension is the Pend d'Oreille River, which is half a mile north of the line. The survey for the extension was begun last summer, and was nearly completed to Kootenay when the engineers were compelled to cease work a few weeks ago on account of the depth of snow. The first two miles will be solid rock work in the ledges along the river. L. A. Clark has the contract for that work, and Renn & Greene, of Missoula, Mont., for the grading on the last eight miles.

Texas, Louisiana & Eastern.—James A. Smyth, of Conroe, Tex., Secretary, reports that the grading reached Cleveland, Tex., this week. Rails are delivered to complete the road from Conroe east to that town, and will at once be laid, now that the grading has been done. The work has been greatly retarded on account of the wet weather.

Texas Midland.—A charter was filed in Texas last week for this company, which is to operate the road between Ross and Garrett, Tex., 52 miles, heretofore known as the northwestern division of the Texas Central. An extension is proposed from Roberts to Greenville, Tex.

Union Pacific.—Surveys for a narrow gauge line are being made from Pitkin, Col., to the anthracite coal mines near Irwin, which are owned by the railroad. The line will probably be built at an early date, in which event the abandoned Alpine tunnel will be opened next spring. No other extensions are contemplated. The branch will be 15 miles long, six miles being already graded.

Wabash.—The last track on the Detroit and Chicago extension was laid on Dec. 17, at Clark Station, near Valparaiso, Ind. Traffic will probably begin over the new line about Jan. 1, the trains now running west of Montpelier, O., where the new road begins, to Ashley, Ind. The line connects at Hammond, Ind., the western terminus, with the Chicago & Northern Pacific.

Washington Southern.—President James R. McDonald has returned to Seattle after nearly a year's absence in Europe, and he announces that he succeeded in negotiating the sale of $1,000,000 of this company's bonds to build proposed extensions in Southwestern Washington. The road will first be extended from Shelton, Wash., its present eastern terminus, north and west to some point on the straits yet to be determined upon, to reach the timber and mineral country.

Wood Mountain & Qu'Appelle.—Last week the rate payers of the municipality of Qu'Appelle, Man., carried a by-law granting a bonus of $20,000 to aid in the construction of this road from Qu'Appelle to the Canadian Pacific, the road to be completed by Nov. 1, 1893.

Woodstock & Centreville.—Connor, Lawlor & Co., of St. John, N. B., who have the contract for building this road, are delivering a large amount of ties, rails and other construction material at Woodstock, N. B., and are prepared to begin the grading as soon as the weather is at all favorable. The contracts with the Local and Dominion Governments have been signed by the company. The new line is to extend from Upper Woodstock on the New Brunswick Road north to Centreville, N.B., about 15 miles.

Wyoming and Utah.—Articles of incorportion of the Company have been filed with the Secretary of State in Wyoming and in other States. The company is to build a line southwest from the town of Casper, Wyo., the terminus of the Wyoming lines of the Chicago & Northwestern to the city of Odgen, Utah, with branches to Rawlins and Lander, Wyo. The capital stock is placed at $10,000 000.

Yakima & South Coast.—Passenger trains are running on this road, the South Bend branch of the Northern Pacific, as far as the south fork of the Willapa River. The tracks are now laid to within two miles of South Bend, Wash., on the Pacific coast, the terminus of the road.

GENERAL RAILROAD NEWS.

Brighton & Boulder.—The name of the branch road between Brighton and Boulder, Colo., operated by the Union Pacific, and known as the Denver & Boulder Valley, has been changed as above.

Cresson & Clearfield County & New York Short Line.—This road has been sold to and merged into the Pennsylvania system. The property will be formally taken possession of by the new owners on Jan. 1 next. This line is 30 miles in length and extends from Cresson, Cambria County, to Irvona, Clearfield County.

Kentucky Union.—A sale of the road has been ordered by the United States Circuit Court at Louisville, at the suit of the first mortgage bondholders, unless the amount of the defaulted bonds is paid within 120 days.

Ohio & Mississippi.—The Supreme Court of Ohio this week handed down a decision confirming the judgment of the Circuit Court in the suit concerning the election of directors, confirming the validity of the vote of the majority shareholders for election of directors held in October, 1891, on the Brown-Shipley trust stock. The Court holds that the trust is valid, that McKim, Walsh and Fabnestock were legally elected directors, and that Smith, Green and Whittaker were wrongfully seated as directors.

Panama.—Two steamships of the Mallory line have been chartered by the company. This step is taken by the railroad company in anticipation of the expiration on Feb. 1 of its contract with the Pacific Mail Steamship Co. After that date the two steamers will ply between New York City and Colon, and others will be added to the service as occasion requires.

Richmond & West Point Terminal Co.—The long threatened suit to this company to recover she securities delivered in exchange for the control of the Central of Georgia was begun this week in the New York Supreme Court by Walter G. Oakman, Receiver and President of the company. The object of the suit is to set aside and have declared null and void the sale of $16,000,000 of securities of the Georgia Co., to the Richmond Terminal.

Texas Central.—New articles of incorporation were filed in Texas last week for the road from Ross to Albany, Tex., 178 miles which has been operated under this name since the foreclosure sale in 1891 by the committee of first mortgage bondholders.

TRAFFIC.

Traffic Notes.

The Wabash has issued a notice discontinuing stop-over privileges after Jan. 1 on all kinds of tickets, both of its own issue and those of other lines.

The shipments of the California Fruit Union for the season are given by its manager as 1,700 carloads, an increase of 400 carloads over the ship nents of last year.

The Wabash is to run those of its trains which connect with the Grand Trunk through the Port Huron tunnel. This will cause a reduction in the ferry service between Windsor and Detroit.

On the night of Dec. 17, 18 carloads of oysters in barrels were shipped from Baltimore over the Northern Central, and the Adams Express took out 12 carloads over the same road the same night.

The Louisiana law compelling railroads to provide separate and equal accommodations in passenger cars for the two races, white and black, has been declared constitutional by the Supreme Court of that state.

A press dispatch from Duluth, Dec. 20, reports that the stock of wheat in that city now aggregates 12,754,000 bushels. The receipts now are very heavy, and it is expected that there will be 16,000,000 bushels stored at Duluth for vessels in the spring.

The Railroad Commissioners of Iowa recently ordered the Chicago, Milwaukee & St. Paul to put an additional train on the branch to the town of Waukon, but it is now stated that the people differed so much about the time the train should run that the whole matter has been dropped.

The negotiations for a pooling agreement between the Hocking Valley coal producers and the railroad companies are nearly completed. The various differences were left to a committee on arbitration, which is now holding daily sessions. It is expected that the shippers will receive 30 cents a ton more than the present circular price.

The subject of the interchange of annual and time passes among railroad officials was discussed at the meeting of the Executive Committee of the Trunk Line Association on Tuesday last. The custom of issuing annual passes to subordinate officials of small roads has become so burdensome that it was decided to recommend to the Board of Presidents that they make a list of officials whose positions should entitle them to such courtesies. At the meeting of passenger agents it was decided to issue tickets to clergymen and persons engaged exclusively in pastoral duties or in work of charity, after Jan. 1, at half the limited fares in Trunk line territory and at half the unlimited in outside territory.

A general meeting of the managers of the Central Traffic and Trunk Line Associations was held in New York on Wednesday, which was the first meeting presided over by the newly elected Chairman of the Joint Committee, Mr. Aldan F. Walker. The subjects considered were: Export rates, via all roads, rates upon dressed meats, mileage upon private cars, issuance of passes, differentials via transfer routes across Lake Michigan, issue of joint notice touching non-payment of commissions and other matters. No results are given out, but it is understood that a proposition to raise the dressed beef rates to the basis of 45 cents, Chicago to New York was favorably passed upon. The discussion called attention to the fact that the contracts by which the Wabash and the Canadian Pacific pay a cent a mile for private owners' refrigerator cars west of Toronto have two years yet to run.

The New York Central has lately found passengers who have ridden on its trains for two years without paying the proper fare. It appears that the trains on the Buffalo Belt Line stop at many stations which are close together, and that there has been considerable agitation of the project of compelling the road to adopt a uniform rate of five cents to all stations within certain limits. The movement did not amount to anything, but a great many passengers concluded to make the reduction on their own responsibility, and the imposition practiced by them had finally grown to such an extent that the company made a special examination the other night and detected a large number of passengers who bought tickets to one station and rode to another beyond. One woman said that she had ridden from Buffalo to Black Rock every night for two years for five cents, which is less than the regular rate. Others had done the same thing.

Chicago Traffic Matters.

CHICAGO, Dec. 21, 1892.

The committee of representatives of the passenger department of the Western lines, sitting with Chairman Caldwell of the Western Passenger Association, are now in session considering plans for a revision of the existing agreement, and the indications are that they will agree upon a report. General Passenger Agent Charlton, of the Alton, is a member of the committee and it is understood that the Alton will subscribe to a revised agreement provided the Jacksonville Southeastern also becomes a party to it. As the Santa Fé's demand for relief against its competitors between Chicago and the Missouri River undoubtedly hastened the present meeting, it is quite probable that if the Alton will come into a new agreement with the other lines that the Santa Fé will prevail upon the Jacksonville Southeastern to also join rather than be the cause of a failure of the scheme.

The Western Freight Association adjourned Saturday after one of the longest sessions for some time. A large number of changes in rates were authorized. This was the first regular meeting since the formal dissolution of the Western Traffic Association, and some of the members of the Western Freight Association took the opportunity to give a large number of ten-day notices of changes in rates. This they could not do while members of the Western Traffic, and it looks as though they had been accumulating these notices for some time in anticipation of the time when they would be free to insist upon their demands. Among other changes it was voted to apply Missouri River rates from Iowa points on the Illinois Central from Cherokee to Onowa, inclusive, to California terminals; a rate of $2 per gross ton on pig iron, c. l., Mississippi River to Missouri River, and $2.30 to Lincoln, and $2.60 to Beatrice; a rate of 12 cents per 100 lbs. on salt, c. l., Chicago to Missouri River points, with corresponding reductions to other points. It will be remembered that the Commissioners of the Western Traffic Association steadily opposed this reduction on salt, the matter being before them several times. It was decided that Chicago rates should apply from Kewanee to St. Paul as proportions of through rates to meet the competition of the "Soo" line.

The Central Traffic Managers at their meeting last week agreed that after Jan. 1, 1893, half-fare clergy rates shall be granted only to clergymen and missionaries and Sisters of Charity in active service, when provided with proper credentials, and that no reduction will be made for members of the families of the clergy.

The question of the payment of drayage and switching charges was again considered by the managers of the Central Traffic lines at their recent meeting, but no agreement was reached, as the Chicago & Grand Trunk absolutely refuses to stop the payment of drayage until satisfied that its competitors will honestly enforce such an agreement. Consequently, the whole subject was referred back to the committee having it in charge for further consideration and report.

A committee consisting of Messrs. Sebastian, of the Rock Island, White of the Santa Fé, Heafford of the St. Paul, Busenbark of the Chicago Great Western, and Pond of the Wisconsin Central, has been appointed by Chairman Caldwell, of the Western Passenger Association, to confer with representatives of the Canadian Pacific and Soo line in regard to immigrant rates and commissions. There are so many conflicting interests now at work producing the present demoralization in commissions that it is difficult to see how any agreement can be arrived at. The Western Traffic Association presidents labored with the question for six months and finally got up an agreement and presented it for signatures, when it was found that several of the important lines were not ready to sign, alleging that "the other fellow" must sign first. This will probably be the result of the present effort.

Central Traffic Association managers did not agree upon any details for World's Fair rates, and the subject goes over until the next meeting. They probably thought that there was plenty of time yet to make rates.

Chairman Caldwell rules that votes in the Western Passenger Association upon propositions for reduced rates should be public. Many of the members object to this, as they say lines who may wish to make the rates, but are voted down, will curry favor with the public by "giving the thing away." Probably the Committee on Revision will endeavor to remedy this by providing explicitly for a secret ballot on such questions.

The shipments of eastbound freight, not including live stock, from Chicago by all the lines for the week ending Dec. 17, amounted to 78,443 tons, against 77,188 tons during the preceding week, an increase of 255 tons, and against 120,361 tons during the corresponding week of 1891. The proportions carried by each road were:

Roads.	W'k to Dec. 17.		W'k to Dec. 10.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	10 2'5	13.1	12.338	16.1
Wabash	4,853	6.2	3,861	5.0
Lake Shore & Michigan South.	12,767	16 3	14.598	18.9
Pitts., Ft. Wayne & Chicago	7,997	10.2	8,494	11.0
Pitts., Cin., Chicago & St. Louis	9,3 6	11.9	9,649	12 5
Baltimore & Ohio	2,698	3.4	3,500	4.5
Chicago & Grand Trunk	9,684	12.4	6,438	8.3
New York, Chic. & St. Louis	11,840	15.0	9,099	11 8
Chicago & Erie	7,488	9.5	6,277	8 1
C., C., C. & St. Louis	1,535	2.0	2,914	3.8
Total	78,443	100.0	77,188	100.0

Of the above shipments 11,371 tons were flour, 34,088 tons grain and millstuff, 10,825 tons cured meats, 11,832 tons dressed beef, 2,243 tons hides, and 4,766 tons lumber. The lake lines carried 11,380 tons, against 10,033 tons during the preceding week.

Earnings of Express Companies.

The total gross earnings of the express companies in the United States and Canada for the year ending June 30, 1890, may be closely computed at $50,500,000. The third annual report of the Interstate Commerce Commission gives the earnings received by the railroads for furnishing express transportation facilities. Official reports were received for 159,271 miles, leaving only 4,325 miles unreported. These 159,271 miles netted $20,277,711 in express earnings. Estimating this sum as 40 per cent. of the gross express income, the general average cost of railroad transportation, and making allowances for the 4,325 unreported mileage and the revenues received by the express companies from stage and water lines, we can safely estimate the gross express earnings for 1890 at fifty and a half millions of dollars.—*Express Gazette.*

GEO. WESTINGHOUSE, JR., President. T. W. WELSH, Supt. JOHN CALDWELL, Treasurer. W. W. CARD, Secretary. H. H. WESTINGHOUSE General Manager.

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PITTSBURGH, PA., U. S. A.,

MANUFACTURERS OF THE

WESTINGHOUSE AUTOMATIC BRAKE

The WESTINGHOUSE AUTOMATIC BRAKE is now in use on 24,000 engines and 325,000 cars. This includes (with plain brakes) 232,000 freight cars, which is about 23 PER CENT. of the Entire Freight Car Equipment of this country, and about 80 per cent. of these are engaged in interstate traffic, affording the opportunity of controlling the speed of trains by their use on railways over which they may pass. Orders have been received for 173,000 of the Improved Quick-Action Brakes since December, 1887.

The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped. Below is a graphical illustration of the progress made in the application of the Automatic Brake to freight cars since its inception

Year.	No. per year.	Grand total
1881	105	105
1882	1,085	1,190
1883	4,966	6,156
1884	15,051	21,207
1885	10,410	31,617
1886	8,946	40,563
1887	9,281	49,844
1888	27,696	77,540
1889	26,065	103,605
1890	50,502	154.107
1891	39,061	193,168

193,168 freight cars fitted with the Westinghouse Automatic Brake, which is nearly 20 per cent. of the Entire Freight Car Equipment of this country.

E. L. ADREON, Manager. JOHN B. GRAY, Agent. C. C. HIGHAM, General Supt.

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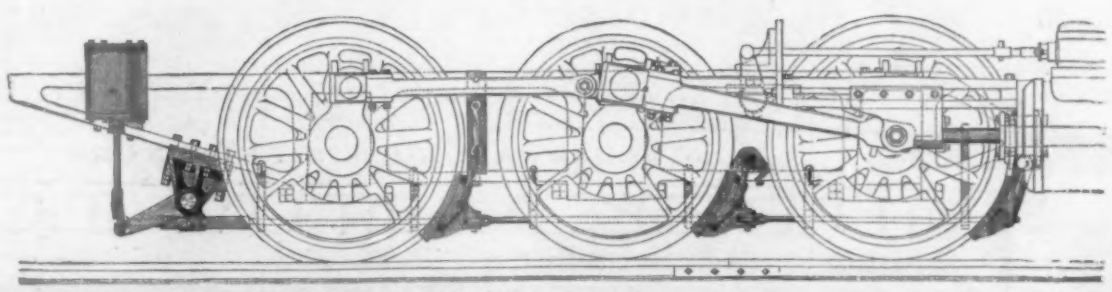

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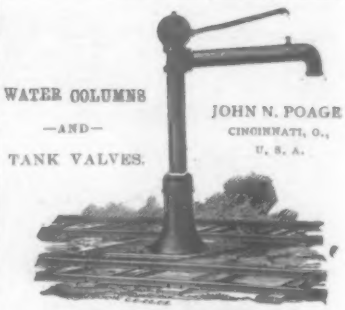

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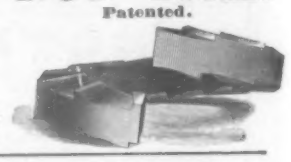

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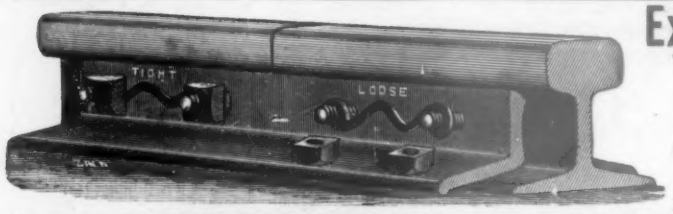

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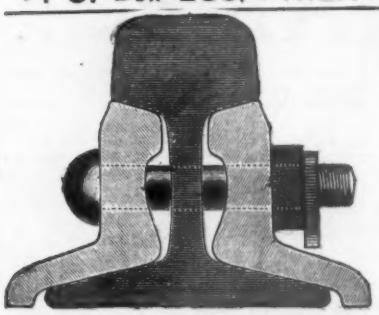

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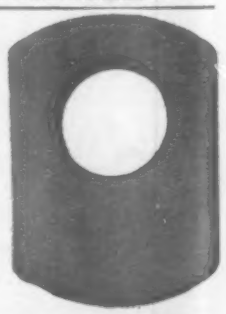

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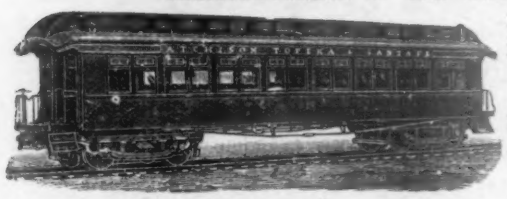
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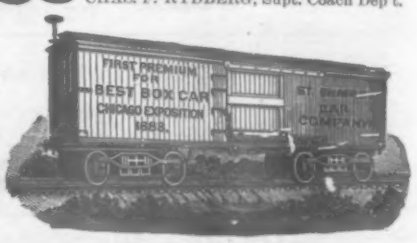
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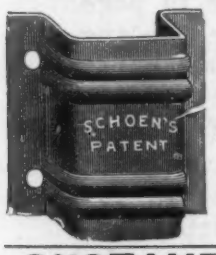

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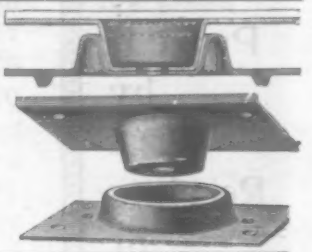

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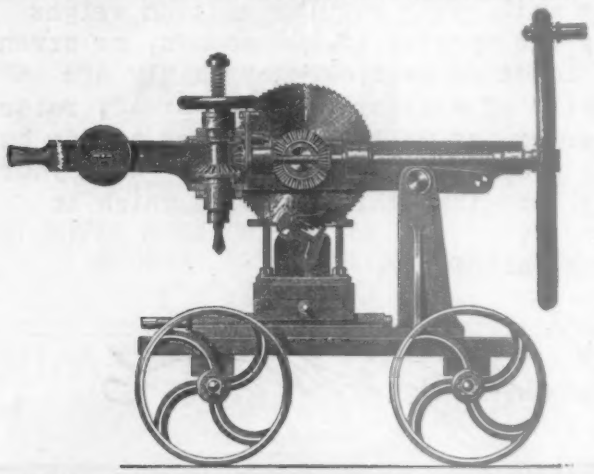

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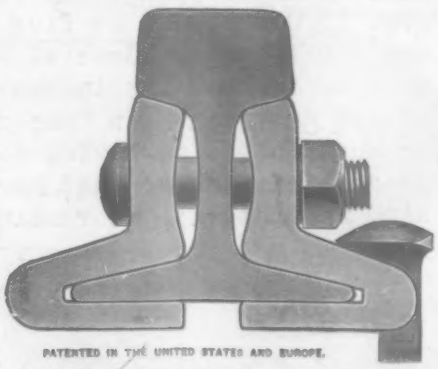

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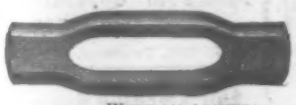

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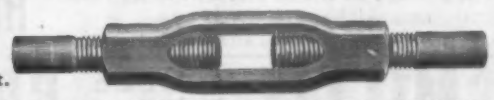

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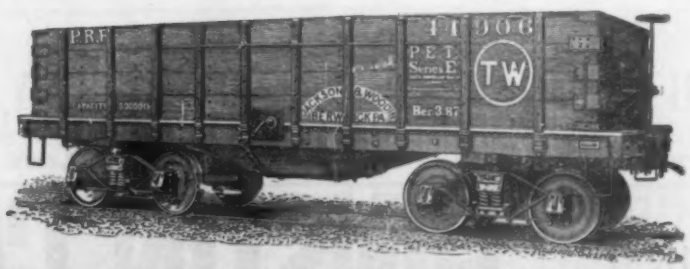

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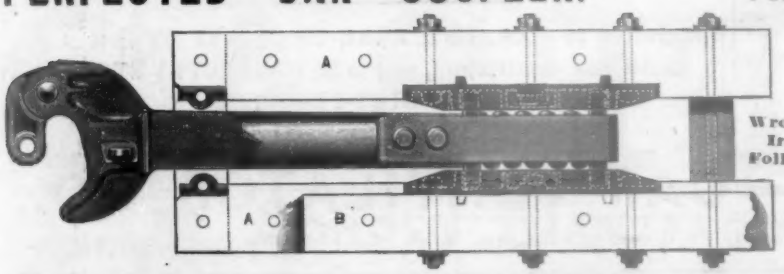

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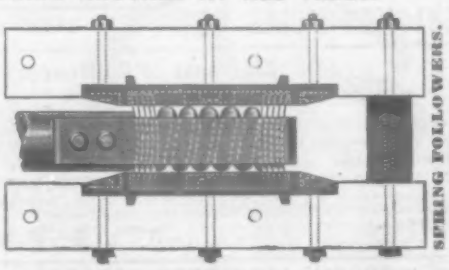

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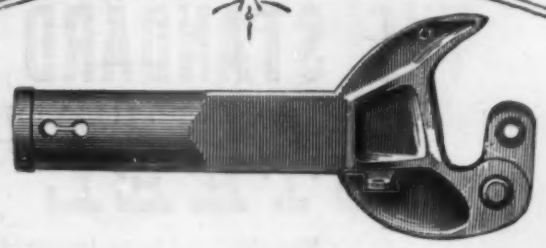

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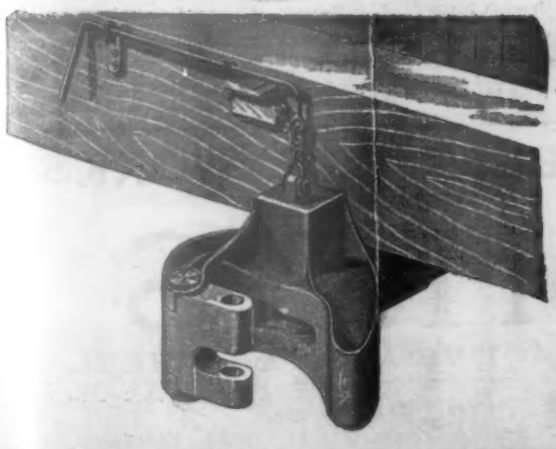

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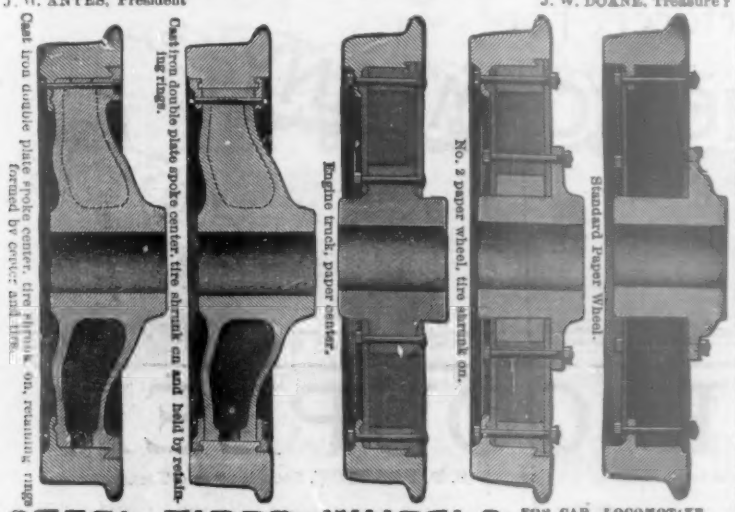
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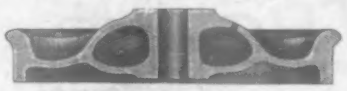

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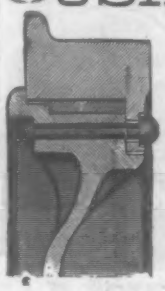

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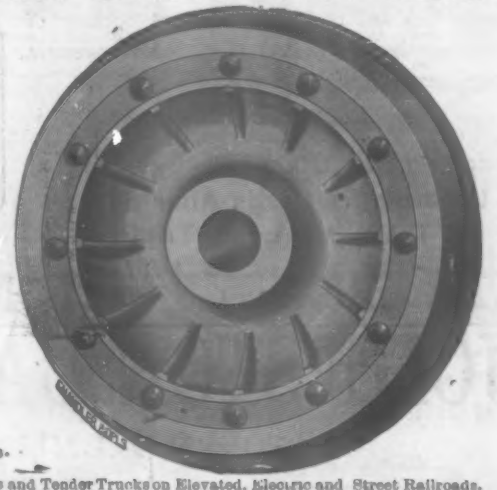

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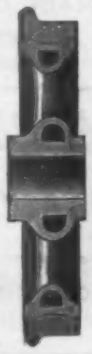

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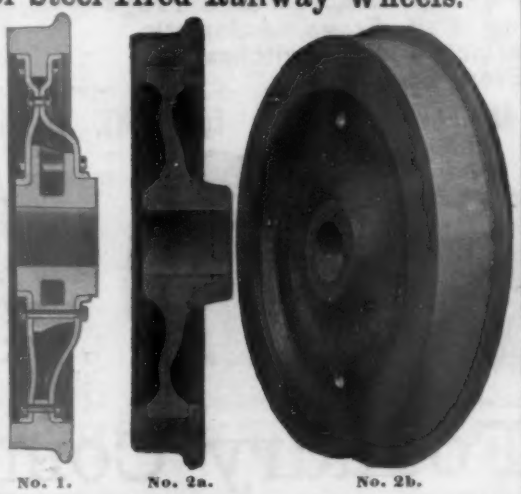

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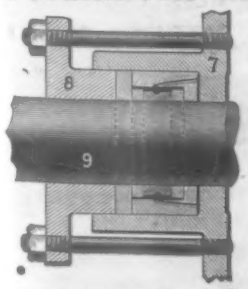

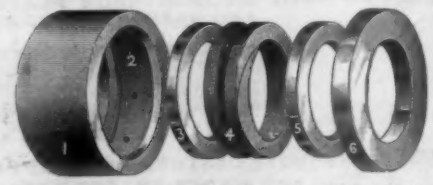

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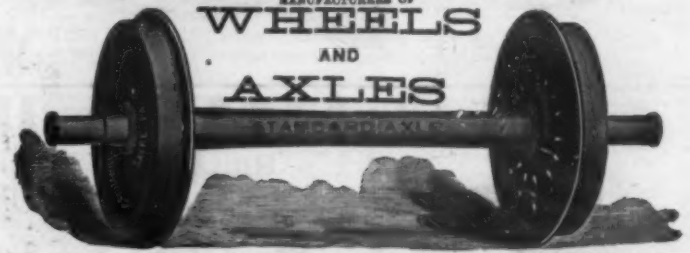

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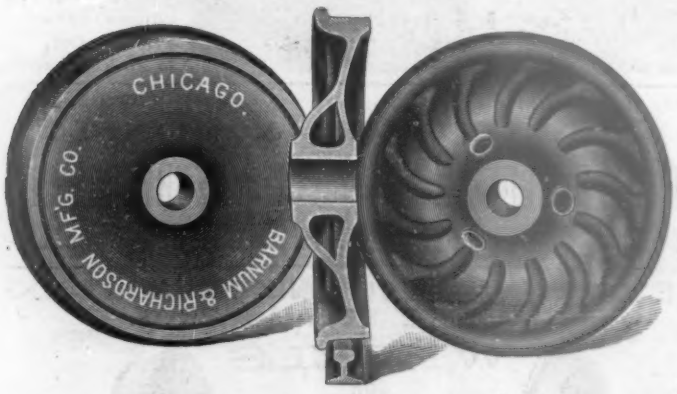

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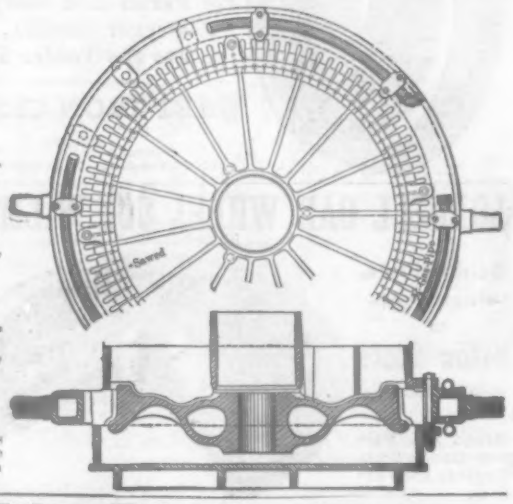

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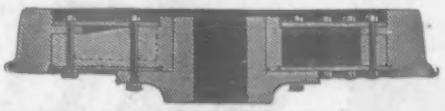

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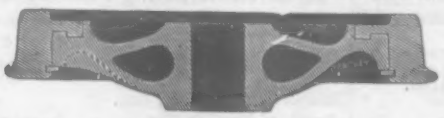

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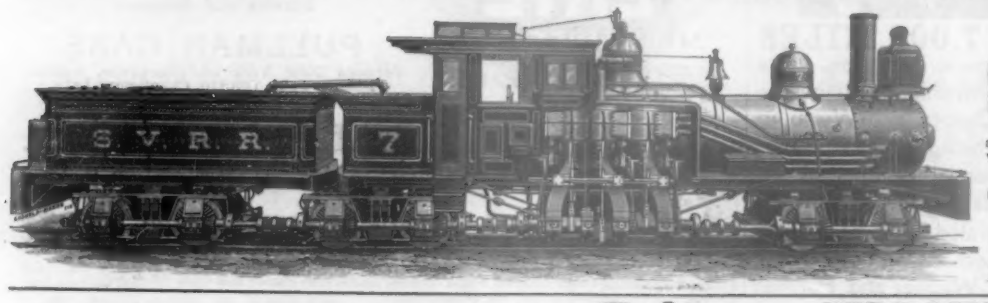

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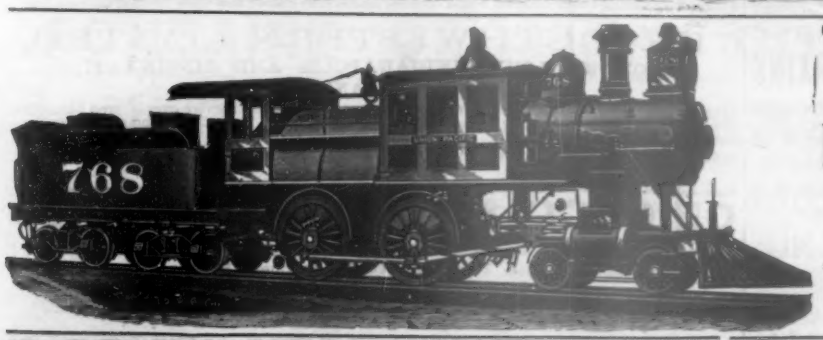

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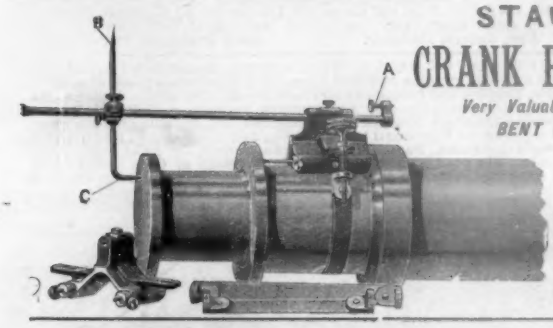

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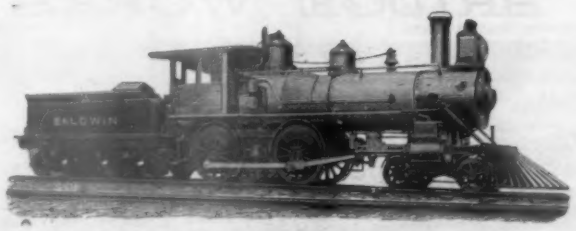

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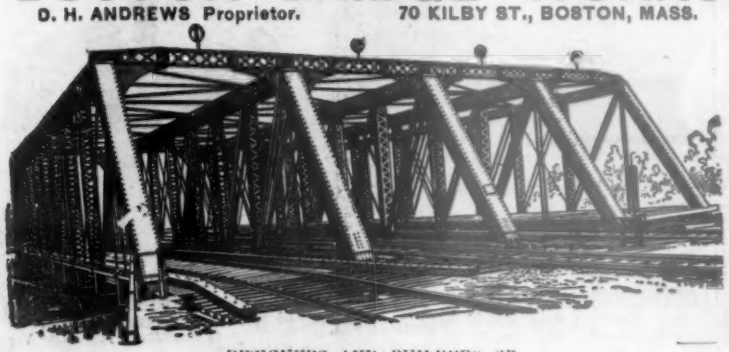

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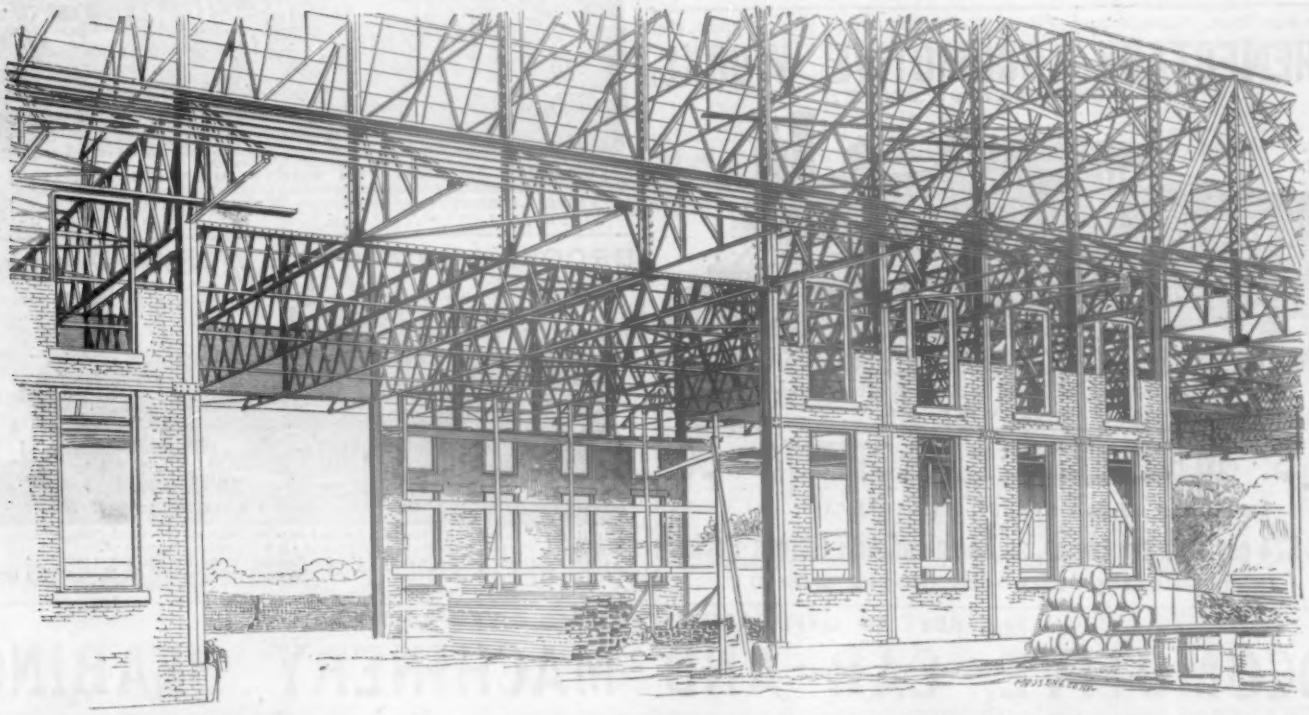

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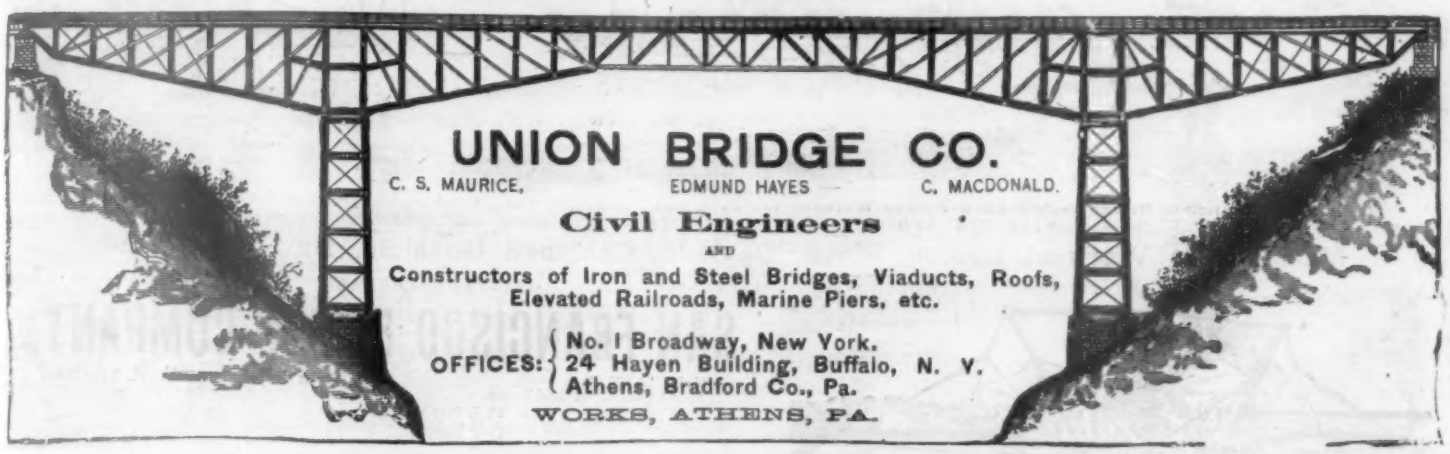

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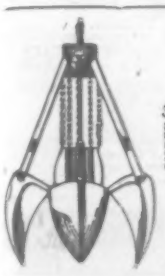

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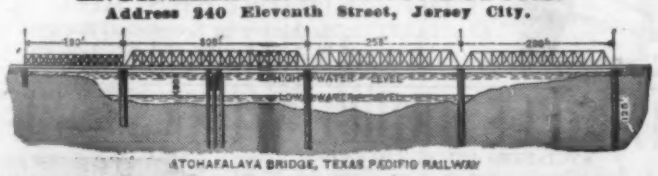

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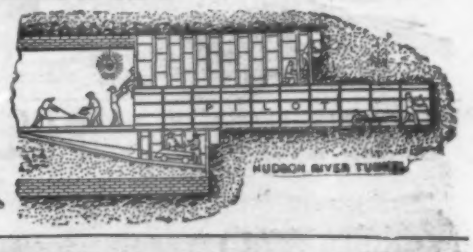

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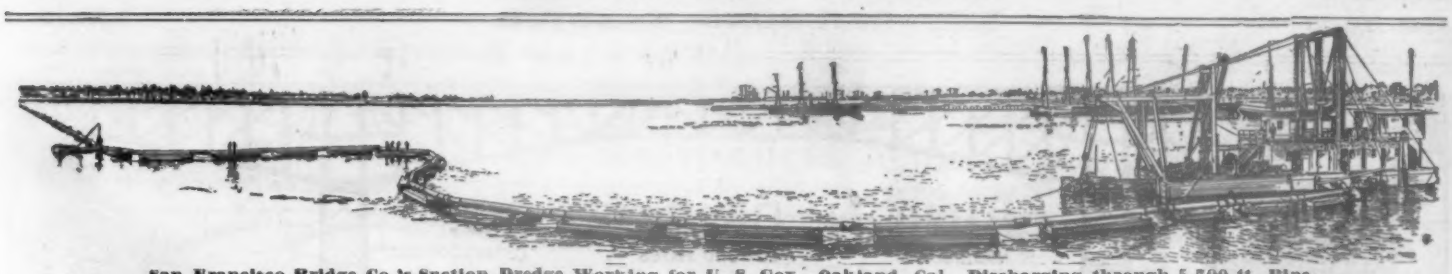

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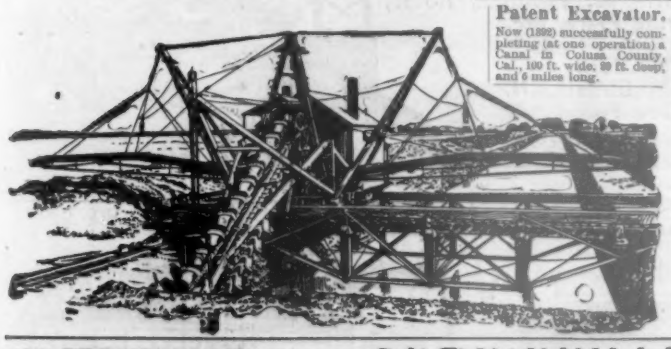

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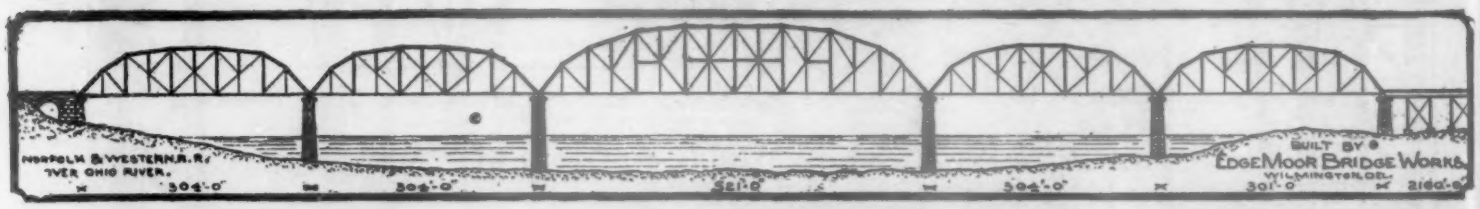

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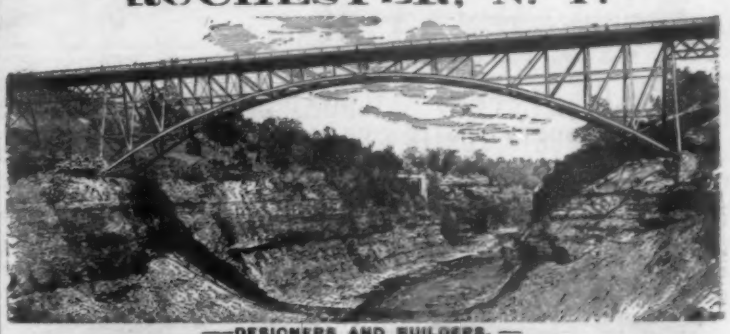

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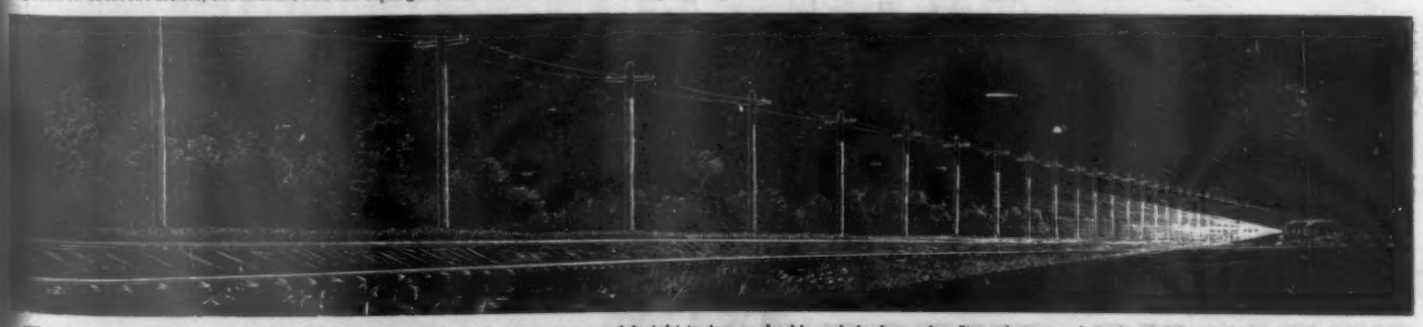

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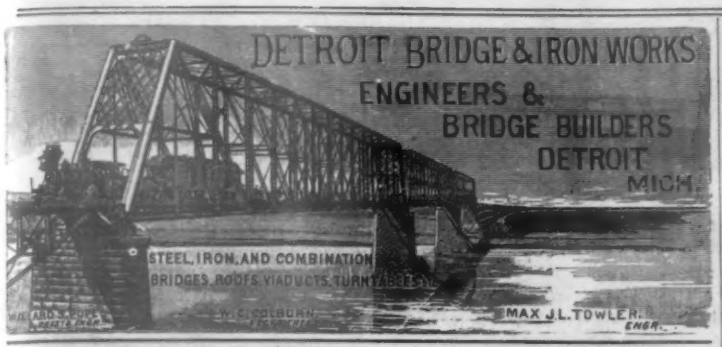

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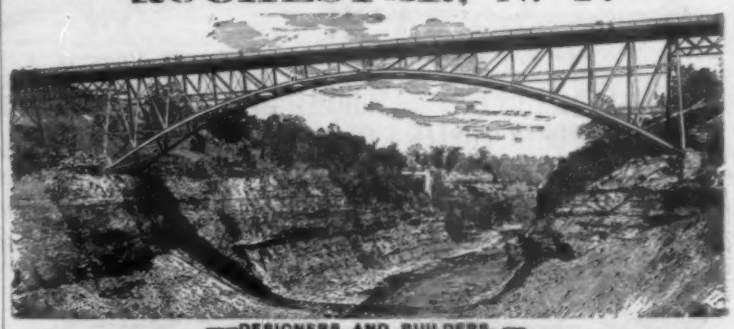

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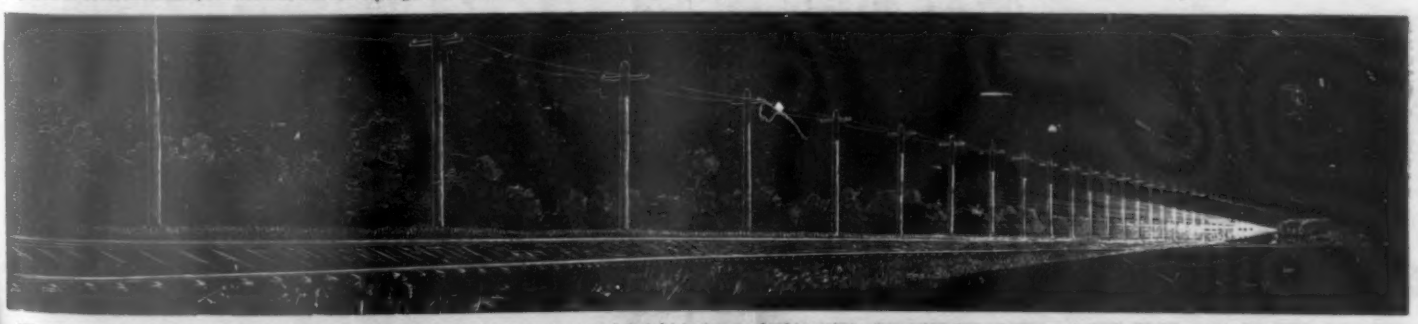

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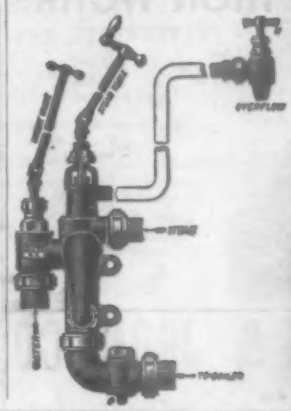
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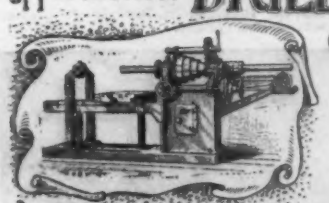
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